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Proximate Biochemical Composition and Antibacterial Potential of the By-catch Marine Fish *Brachypterois serrulifer* (Fowler, 1938) Collected from the Visakhapatnam Coast, India

Madhuri M[1], Sahithi M[1], Askara Y[1], Sunil Kumar D[1], Geetha S[1], Janakiram P[1*]

[1]*Dept. of Marine Living Resources, Andhra University, Visakhapatnam-530003*

***Corresponding author's** E-mail:pjram9999@gmail.com*

Abstract

Marine bycatch species represent an underutilized source of valuable nutrients and biologically active compounds with potential applications in the food, aquaculture, and pharmaceutical industries. The present study evaluated the proximate biochemical composition and antibacterial activity of the by-catch marine fish *Brachypterois serrulifer* collected from the Visakhapatnam fishing harbour along the southeast coast of India. The proximate composition, including moisture, protein, carbohydrate, lipid, and ash content, was determined using standard biochemical methods. The antibacterial activity of crude extracts prepared using wet and dry extraction methods was assessed against *Escherichia coli*, *Staphylococcus aureus*, and *Vibrio parahaemolyticus* using the agar well diffusion technique.

The biochemical composition showed that moisture was the predominant component (83.15–85.35%), followed by protein (7.95–8.70%), lipid (3.70–4.60%), carbohydrate (3.50–3.70%), and ash content (0.64–0.80%). Statistical analysis indicated that seasonal variations among the sampling months were not significant ($p > 0.05$). The crude extracts exhibited antibacterial activity against all the tested bacterial pathogens. The dry extract demonstrated greater antibacterial efficacy than the wet extract, producing the largest inhibition zone against *Vibrio parahaemolyticus* (17 mm), followed by *Escherichia coli* (16 mm), and *Staphylococcus aureus* (14 mm).

The findings demonstrate that *Brachypterois serrulifer*, an underutilized bycatch fish species, possesses appreciable nutritional value and promising antibacterial properties. These characteristics suggest that this species could serve as a potential source of natural antimicrobial compounds and may contribute to the development of value-added products for aquaculture, food, and pharmaceutical applications. Further investigations focusing on the purification and characterization of bioactive compounds are recommended.

Keywords: *Brachypterois serrulifer*; Marine bycatch; Proximate composition; Antibacterial activity; Marine bioactive compounds; *Vibrio parahaemolyticus*; Nutritional quality.

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INTRODUCTION

Marine ecosystems are among the richest reservoirs of biological diversity and are an invaluable source of food, pharmaceuticals, and industrially important biomolecules. Marine fishes are recognized as excellent sources of high-quality proteins, essential amino acids, polyunsaturated fatty acids (PUFAs), vitamins, and minerals that contribute significantly to human nutrition and health (Mohanty et al., 2019). Fish consumption has been associated with reduced risks of cardiovascular diseases, improved cognitive development, and enhanced immune function due to the presence of long-chain omega-3 fatty acids, especially eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) (Calder 2020).

In addition to their nutritional value, marine organisms have attracted considerable scientific attention because they produce structurally diverse bioactive compounds with antimicrobial, antioxidant, antiviral, anti-inflammatory, anticancer, and immunomodulatory properties. These metabolites have become increasingly important in the discovery of novel therapeutic agents owing to the rapid emergence of antimicrobial resistance in pathogenic microorganisms (Mayer et al., 2020). Marine-derived natural products continue to be an important resource for identifying new bioactive molecules with pharmaceutical and biomedical applications.

Commercial marine fisheries generate substantial quantities of bycatch species that are frequently discarded because of their limited market demand, despite possessing considerable nutritional and biochemical value. Utilization of these underexploited fish species can improve resource efficiency, reduce post-harvest waste, and contribute to sustainable fisheries management, while creating opportunities for the development of value-added products for human consumption, aquaculture feeds, and pharmaceutical industries (Mohanty et al., 2019).

The biochemical composition of fish varies considerably depending on the species, habitat, feeding behavior, reproductive status, environmental conditions, and seasonal fluctuations. Proximate biochemical constituents, including moisture, protein, lipid, carbohydrate, and ash, are widely used as indicators of nutritional quality and physiological conditions. The evaluation of these parameters provides valuable information for nutritionists, fishery scientists, food technologists, and aquaculture industries in assessing the commercial and nutritional potential of fish species (Huss, 1995; Mohanty et al., 2019). Your dissertation also identified these parameters as the focus for evaluating the nutritional value of *Brachypterois serrulifer*.

Marine fish also possess highly efficient innate immune defense mechanisms that enable them to survive in microbe-rich aquatic environments. Fish skin mucus, tissues, and internal organs contain a variety of antimicrobial peptides, lysozymes, lectins, complement proteins, proteases, and other defense molecules that inhibit the growth of pathogenic microorganisms. These natural antimicrobial compounds have gained considerable attention as potential alternatives to synthetic antibiotics because they exhibit broad-spectrum antimicrobial activity and minimize the development of antimicrobial resistance (Subramanian et al., 2008; Dash et al., 2021).

Bacterial diseases are a major constraint on aquaculture production worldwide. Pathogens such as *Vibrio parahaemolyticus* cause severe economic losses in shrimp and marine finfish farming, whereas *Escherichia coli* and *Staphylococcus aureus* are important human pathogens associated with foodborne illnesses and opportunistic infections. The increasing prevalence of antibiotic-resistant bacteria has accelerated the search for natural antimicrobial compounds from marine organisms for use in aquaculture, food preservation, and pharmaceutical applications (Cabello et al., 2013; Reverter et al., 2020).

The scorpaenid fish *Brachypterois serrulifer* (Fowler, 1938) is an underutilized bycatch species commonly encountered along the southeast coast of India. Although this species is regularly landed during commercial fishing operations, scientific information regarding its nutritional composition and antimicrobial properties remains scarce. Most previous studies have focused on commercially important marine fishes, while comparatively little attention has been given to low-value bycatch species, despite their potential as alternative sources of nutrients and bioactive compounds. This project specifically addresses this knowledge gap by evaluating the proximate biochemical composition and antimicrobial activity of *B. serrulifer*.

Therefore, the present study aimed to determine the proximate biochemical composition (moisture, protein, lipid, carbohydrate, and ash) and evaluate the antibacterial activity of wet and dry crude extracts of

Brachypterois serrulifer against *Escherichia coli*, *Staphylococcus aureus*, and *Vibrio parahaemolyticus*. The findings are expected to provide baseline information on the nutritional quality and antimicrobial potential of this underutilized marine fish, supporting its future utilization as a valuable resource for food, aquaculture, and pharmaceutical applications

MATERIALS AND METHODS:

Study Area and Sample Collection

Fresh specimens of *Brachypterois serrulifer* (Fowler, 1938) were collected from the Visakhapatnam Fishing Harbor (16°09′51.43″ N, 81°07′28.59″ E) on the southeast coast of India. Fish samples were collected monthly from January to March 2017 immediately after landing and transported to the laboratory in insulated ice boxes. Samples were thoroughly washed with distilled water to remove adhering sand, debris, and mucus before further processing. Morphometric measurements, including total length and body weight, were recorded prior to dissection.

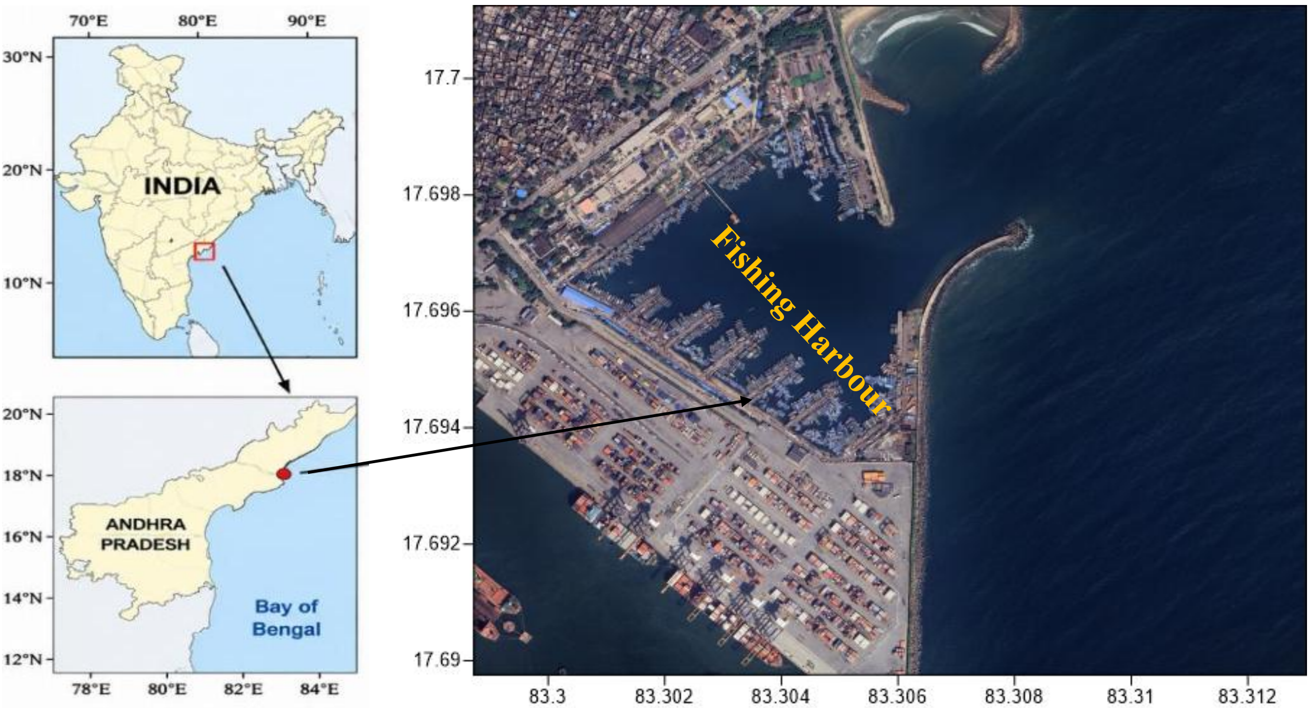

Fig.1: Study area

Sample Preparation

The fish were dissected aseptically, and the muscle tissues were carefully excised for biochemical analyses. Approximately 1 g of muscle tissue was homogenized in chilled distilled water (1:9, w/v) using a laboratory homogenizer. The homogenate was filtered through a sterile muslin cloth and centrifuged at 10,000 rpm for 20 min at 4°C. The supernatant obtained after centrifugation was collected and stored at 4°C until biochemical analyses were performed.

Proximate Biochemical Analysis

The nutritional composition of *B. serrulifer* muscle was evaluated by estimating the moisture, protein, carbohydrate, lipid, and ash contents using standard analytical procedures.

Moisture Content

Moisture content was determined using the standard oven-drying method (AOAC, 2019). Approximately 1–2 g of fresh muscle tissue was dried in a hot air oven at 105°C until a constant weight was obtained. Moisture content was calculated as the difference between fresh and dry weights and expressed as a percentage of wet weight.

Protein Estimation

The total protein content was estimated according to the method described by Lowry et al. (1951). Bovine serum albumin (BSA) was used as the standard, and the absorbance was measured at 540 nm using a UV–visible spectrophotometer. The protein concentration was calculated from a standard calibration curve and expressed as a percentage of wet muscle tissue.

Carbohydrate Estimation
The total carbohydrate content was estimated using the anthrone method described by Hedge and Hofreiter (1962). Glucose served as the standard, and absorbance was measured at 490 nm. Carbohydrate concentration was calculated using a standard curve and expressed as a percentage of muscle tissue.

Lipid Estimation
The total lipid content was determined using the phosphovanillin method, with olive oil as the standard. The extracts were reacted with concentrated sulfuric acid and phosphovanillin reagent, and the absorbance was recorded at 540 nm. The lipid content was calculated from a standard calibration curve and expressed as a percentage of wet muscle tissue.

Ash Content
The ash content was determined following the AOAC (2019) method. Dried muscle samples were incinerated in a muffle furnace at 550°C for 12 h. After cooling in a desiccator, the ash residue was weighed, and the ash content was expressed as a percentage of the dry sample weight.

Preparation of Crude Extracts:

Wet Extract:
Fresh gut, viscera, and gonadal tissues were aseptically excised, cut into small pieces, and homogenized using sterile mortar and pestle. The homogenized tissue was extracted with methanol:chloroform (9:1, v/v) at a ratio of 1:10 (w/v) for 72 h at RT. The extract was then filtered and concentrated under reduced pressure using a rotary evaporator. The concentrated crude extract was stored at 4°C until further analysis.

Dry Extract:
Fresh tissues were dried in a hot-air oven at 55°C for 72 h and pulverized into a fine powder. The powdered material was extracted using methanol:chloroform (9:1, v/v) at a ratio of 1:10 (w/v) for 72 h. The extract was filtered and concentrated under reduced pressure using a rotary evaporator and stored at 4°C for antibacterial analysis.

Antibacterial Activity:
The antibacterial activities of the wet and dry crude extracts were evaluated against *Escherichia coli*, *Staphylococcus aureus*, and *Vibrio parahaemolyticus* using the agar well diffusion method described by Perez et al. (1990). The test organisms were cultured in nutrient broth and incubated at 37°C for 24 h. Mueller–Hinton agar plates were inoculated with the respective bacterial cultures, and wells with a 6 mm diameter were prepared using a sterile cork borer. Each well was loaded with 100 µL of crude extract, and the plates were incubated at 37°C for 24 h. Antibacterial activity was assessed by measuring the diameter of the inhibition zones in millimeters.

Statistical Analysis:
All experimental data are expressed as mean ± standard deviation (SD). Statistical analysis was performed using the SPSS software to determine differences in biochemical parameters among sampling months. One-way analysis of variance (ANOVA) was used to evaluate statistical significance, with $p < 0.05$ considered statistically significant.

RESULTS:
Proximate Biochemical Composition
The proximate biochemical composition of *Brachypterois serrulifer* collected from the Visakhapatnam coast between January and March 2017 is presented in Table 1 and Fig. 2. Moisture was the predominant biochemical constituent throughout the study period, followed by protein, lipid, carbohydrate, and ash. Moisture content ranged from 83.15 ± 1.24% in February to 85.35 ± 1.12% in March, with the highest value recorded in March. Protein content varied between 7.95 ± 0.29% (February) and 8.70 ± 0.28% (January). Carbohydrate content showed only slight variation, ranging from 3.50 ± 0.19% in January to 3.70 ± 0.17% in February. Lipid content

was highest in January (4.60 ± 0.76%) and gradually decreased to 3.70 ± 0.76% in March. Ash content remained the lowest among all biochemical constituents, ranging from 0.64 ± 0.05% in February to 0.80 ± 0.08% in January. Overall, only minor monthly fluctuations were observed in all proximate components, indicating a relatively stable biochemical composition during the sampling period.

Statistical Analysis of Biochemical Parameters

One-way analysis of variance (ANOVA) revealed no significant differences in the biochemical composition of *B. serrulifer* among the three sampling months ($F = 0.0074$; $p = 0.9926$). These findings indicate that the proximate composition remained statistically unchanged during the study period, despite slight numerical variations observed in the individual biochemical constituents (Table 1; Fig. 2).

Antibacterial Activity of Crude Extracts

The antibacterial activity of the wet and dry crude extracts of *Brachypterois serrulifer* against *Escherichia coli, Staphylococcus aureus*, and *Vibrio parahaemolyticus* is presented in Table 2, while representative agar well diffusion plates are shown in Fig. 3 and the comparative inhibition zones are illustrated in Fig. 4. Both wet and dry extracts inhibited the growth of all tested bacterial pathogens. However, the dry extract consistently exhibited greater antibacterial activity than the wet extract.

Among the tested pathogens, *Vibrio parahaemolyticus* showed the highest susceptibility, for the dry and wet extracts, respectively. The lowest inhibition was recorded against *Staphylococcus aureus*. The agar well diffusion images (Fig. 3) clearly demonstrate the formation of inhibition zones around the wells, whereas the bar graph (Fig. 4) quantitatively compares the antibacterial efficacy of the wet and dry extracts. Overall, the results indicate that the drying process did not reduce antibacterial activity and may have enhanced the concentration of bioactive compounds responsible for bacterial inhibition.

Table 1: Proximate biochemical composition (%) of *Brachypterois serrulifer* collected from the Visakhapatnam coast, India.

Month	Moisture (%)	Carbohydrate (%)	Protein (%)	Lipid (%)	Ash (%)
January	83.90 ± 1.11	3.50 ± 0.19	8.70 ± 0.28	4.60 ± 0.76	0.80 ± 0.08
February	83.15 ± 1.24	3.70 ± 0.17	7.95 ± 0.29	4.55 ± 0.36	0.64 ± 0.05
March	85.35 ± 1.12	3.60 ± 0.13	8.50 ± 0.20	3.70 ± 0.76	0.74 ± 0.04

Table 2: Antibacterial activity of wet and dry crude extracts of *Brachypterois serrulifer*.

Test organisms	Concentration of extract (mg/mL)	Zone of inhibition (mm, Mean ± SD)	
		Wet extract	Dry extract
Escherichia coli	25	14.00 ± 0.58	16.00 ± 0.58
	50	16.00 ± 0.58	17.50 ± 0.58
	75	18.50 ± 0.58	19.50 ± 0.58
Staphylococcus aureus	25	12.00 ± 0.58	14.00 ± 0.58
	50	13.50 ± 0.58	15.00 ± 0.58
	75	15.50 ± 0.58	16.50 ± 0.58
Vibrio parahaemolyticus	25	16.00 ± 0.58	17.00 ± 0.58
	50	17.00 ± 0.58	18.00 ± 0.58
	75	18.50 ± 0.58	19.50 ± 0.58
Control (solvent)	–	0	0

Note: Values are expressed as mean ± standard deviation (SD), $n = 3$. "–" indicates not applicable.

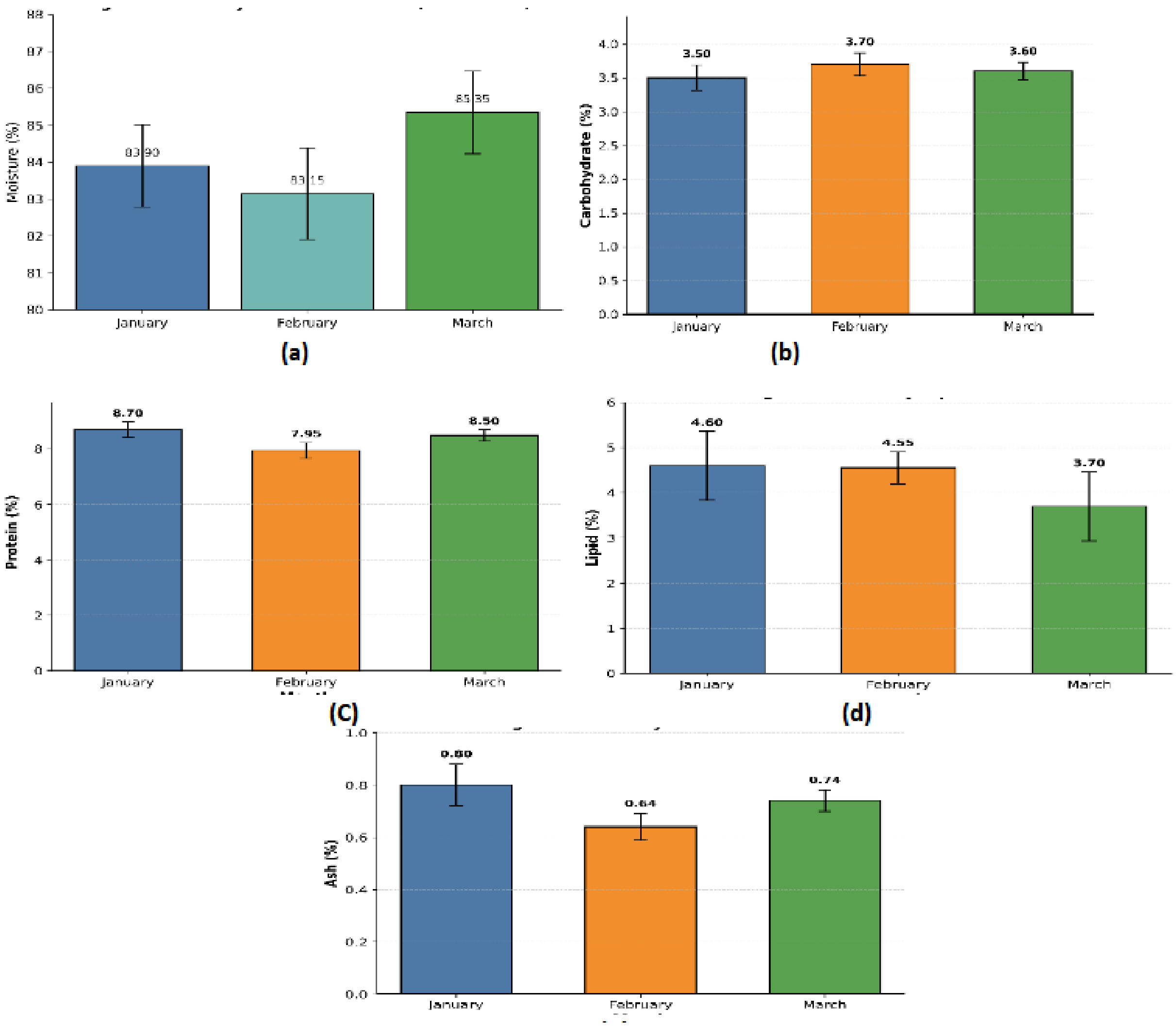

Fig. 2: Monthly variations in proximate composition (Mean ± SD)
(a)- Moisture (%), (b)-Carbohydrate (%) (c)- Protein (%) (d) Lipid (%), (e) Ash (%)

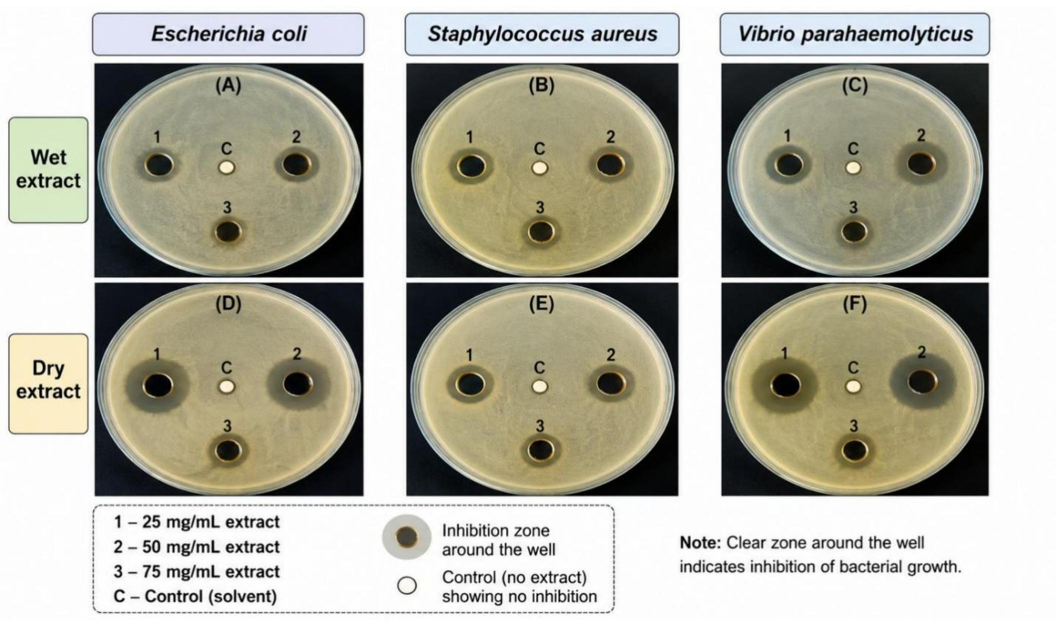

Fig. 3: Antibacterial Activity of Crude Extracts by Agar well diffusion method against
(a) *E.coli* (b) *S.aureus* (c) *V. parahaemolyticus*

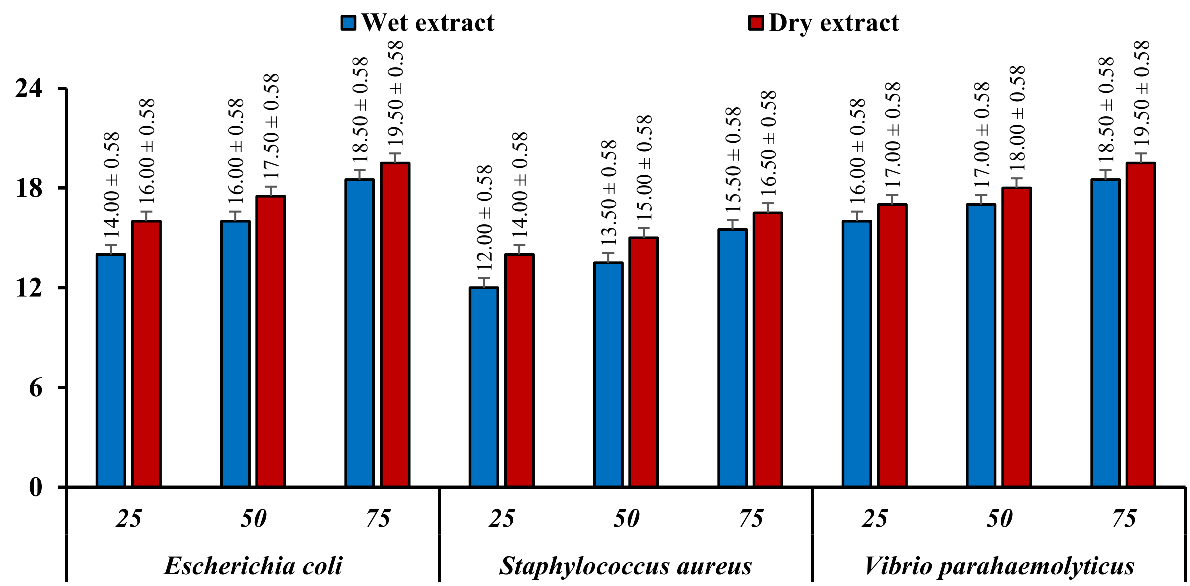

Fig. 4: Antibacterial activity of wet and dry crude extracts of *Brachypterois serrulifer*

Discussion:

The present study investigated the proximate biochemical composition and antibacterial activity of the underutilized marine by-catch fish *Brachypterois serrulifer* collected from the Visakhapatnam coast, India. The findings demonstrated that *B. serrulifer* possesses a stable nutritional composition and exhibits promising antibacterial activity against both human and aquatic bacterial pathogens. These results suggest that this underutilized species has considerable potential as a functional seafood resource and a source of natural antimicrobial compounds for pharmaceutical and aquaculture applications.

Moisture was the predominant biochemical constituent, ranging from 83.15 ± 1.24% to 85.35 ± 1.12%, with the highest value recorded during March. The consistently high moisture content confirms that *B. serrulifer* is a lean marine fish, as moisture content generally shows an inverse relationship with lipid accumulation (Huss, 1995; Ozogul and Ozogul, 2007; Mohanty et al., 2019). Similar moisture values have been reported in several tropical marine fishes, where seasonal environmental fluctuations exert only limited influence on muscle water content (Aberoumad and Pourshafi, 2010; Mohanty et al., 2019). The narrow variation observed among sampling months is further supported by the statistical analysis, which revealed no significant seasonal differences ($p > 0.05$), indicating a relatively stable physiological condition during the study period.

Protein content varied between 7.95 ± 0.29% and 8.70 ± 0.28%, with the highest value observed in January. Although these values are lower than those reported for some commercially important marine fishes, they are comparable with those reported for several underutilized by-catch species (Nargis, 2006; Mohanty et al., 2019; Gopakumar, 1997). Protein concentration in fish muscle is influenced by several biological and environmental factors, including feeding intensity, reproductive cycle, age, habitat and seasonal food availability (Love, 1980; Huss, 1995; FAO, 2020). The relatively constant protein content throughout the sampling period suggests that *B. serrulifer* can serve as a reliable dietary protein source despite seasonal variation.

Carbohydrate content remained low (3.50–3.70%) and exhibited minimal monthly variation. Low carbohydrate levels are characteristic of marine fishes because glycogen reserves are limited and carbohydrates contribute only a small proportion of metabolic energy compared with proteins and lipids (Anthony et al., 2000; Ravichandran et al., 2009). Similar carbohydrate concentrations have been reported in marine finfish and shellfish, reflecting the typical biochemical composition of aquatic organisms adapted to protein- and lipid-based energy metabolism (Mohanty et al., 2019; Ackman, 1989). The insignificant variation observed among months further indicates that carbohydrate metabolism remained relatively unaffected during the sampling period.

Lipid content ranged from 3.70 ± 0.76% to 4.60 ± 0.76%, with the highest concentration recorded in January and the lowest in March. Fish containing less than approximately 5% lipid are generally classified as lean or moderately lean species (Pigott and Tucker, 1990). The lipid values obtained in the present investigation therefore suggest that *B. serrulifer* is a nutritionally desirable seafood with relatively low fat content. Lipids in marine fishes are important sources of polyunsaturated fatty acids, particularly EPA and DHA, which contribute to cardiovascular health, neural development and immune function (Calder, 2020; Tocher, 2015). Seasonal fluctuations in lipid content have been associated with reproductive activity, feeding behaviour and environmental conditions (Ozogul and Ozogul, 2007; Mohanty et al., 2019). However, the relatively small

differences observed in the present study, together with the non-significant ANOVA results, indicate that lipid reserves remained comparatively stable throughout the study period.
Ash content varied between 0.64 ± 0.05% and 0.80 ± 0.08%, representing the smallest biochemical fraction. Ash content reflects the total mineral composition of fish muscle and serves as an important indicator of nutritional quality (Asuquo et al., 2004). Comparable ash values have been reported for several tropical marine teleosts and indicate the presence of essential macro- and micro-minerals required for human nutrition (Mohanty et al., 2019; FAO, 2020). The limited monthly variation observed in ash content further supports the conclusion that the nutritional composition of *B. serrulifer* remained relatively constant during the sampling period.
Statistical analysis demonstrated no significant differences ($F = 0.0074$, $p = 0.9926$) among the monthly biochemical parameters. This finding indicates that seasonal variation during the three-month sampling period had little influence on the proximate composition of *B. serrulifer*. Similar observations have been reported for marine fishes inhabiting tropical coastal ecosystems, where relatively stable environmental conditions minimize seasonal changes in tissue composition (Mohanty et al., 2019; Ozogul and Ozogul, 2007). The biochemical stability observed in the present study enhances the potential of this species as a dependable nutritional resource throughout the year.
Marine organisms are recognized as valuable sources of bioactive compounds, including antimicrobial peptides, glycoproteins, lectins, alkaloids, fatty acids and other secondary metabolites that function in innate immune defence (Subramanian et al., 2008; Mayer et al., 2020; Dash et al., 2021). In the present study, both wet and dry crude extracts of *B. serrulifer* exhibited antibacterial activity against *Escherichia coli*, *Staphylococcus aureus* and *Vibrio parahaemolyticus*. However, the dry extract consistently produced larger inhibition zones than the wet extract against all tested pathogens, suggesting that drying may have increased the concentration or extraction efficiency of bioactive compounds without reducing their biological activity.
Among the tested bacteria, *Vibrio parahaemolyticus* was the most susceptible, exhibiting inhibition zones of 17 mm and 16 mm for the dry and wet extracts, respectively. This observation is particularly significant because *V. parahaemolyticus* is an important bacterial pathogen affecting marine aquaculture, causing serious disease outbreaks in shrimp and fish culture systems (De Schryver et al., 2014; Reverter et al., 2020; Kumar et al., 2020). The pronounced activity against *Vibrio* species indicates that *B. serrulifer* may contain antimicrobial compounds with potential application in developing environmentally friendly alternatives to conventional antibiotics used in aquaculture.
The extracts also inhibited the growth of *Escherichia coli* (16 mm and 14 mm) and *Staphylococcus aureus* (14 mm and 12 mm), indicating broad-spectrum antibacterial activity against both Gram-negative and Gram-positive bacteria. Similar antibacterial activities have been reported for extracts obtained from marine fishes, molluscs and crustaceans, where antimicrobial peptides, free fatty acids and lipid-derived metabolites play important roles in microbial inhibition (Subramanian et al., 2008; Mayer et al., 2020). The greater inhibitory effect of the dry extract may be attributed to improved solvent penetration and increased concentration of active constituents following dehydration, a phenomenon previously reported for several marine natural products (Kim and Wijesekara, 2010; Mayer et al., 2020).
Overall, the present investigation demonstrates that *B. serrulifer* possesses a stable proximate biochemical composition together with promising antibacterial activity, particularly against *Vibrio parahaemolyticus*. These findings support the utilization of this underexploited by-catch fish as a valuable marine bioresource rather than as discarded fishery waste. The species has considerable potential for developing functional seafood products, nutraceuticals, natural antimicrobial agents and aquaculture feed additives. Nevertheless, further investigations involving bioassay-guided fractionation, purification and structural characterization of the active compounds, toxicity evaluation, determination of minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC), and elucidation of mechanisms of antimicrobial action are required before commercial applications can be realized.
Marine organisms are recognized as rich sources of antimicrobial compounds, including antimicrobial peptides, glycoproteins, lectins, alkaloids, fatty acids, and secondary metabolites that contribute to innate defense mechanisms (Subramanian et al., 2008; Mayer et al., 2020; Dash et al., 2021). In the present study, both wet and dry crude extracts of *Brachypterois serrulifer* exhibited antibacterial activity against *Escherichia coli*, *Staphylococcus aureus*, and *Vibrio parahaemolyticus*. The dry extract consistently produced larger inhibition zones than the wet extract, indicating that dehydration may have increased the concentration and extraction efficiency of bioactive compounds. Similar enhancement of antibacterial activity using solvent-extracted marine crude extracts has been reported for the marine gastropod *Cellana radiata* collected from the Visakhapatnam coast (Duddu et al., 2017).
Among the tested pathogens, *Vibrio parahaemolyticus* was the most susceptible, producing inhibition zones of 17 mm and 16 mm for the dry and wet extracts, respectively. *Vibrio* species are among the most important

bacterial pathogens responsible for severe disease outbreaks in marine aquaculture, including *Vibrio*sis and acute hepatopancreatic necrosis disease (AHPND), resulting in substantial economic losses in shrimp farming (De Schryver et al., 2014; Reverter et al., 2020). Comparable antibacterial activity against shrimp pathogenic *Vibrio* species has previously been reported by Duddu et al. (2017), who demonstrated that crude extracts of *Cellana radiata* showed maximum inhibition against *Vibrio* harveyi, with the ethyl acetate wet extract producing an inhibition zone of 18 mm. Similarly, Sunil Kumar et al. (2017) isolated a purified antibacterial compound from the marine bivalve *Anadara granosa* that exhibited significant inhibitory activity against *Vibrio* harveyi, confirming that marine organisms are promising sources of antibacterial metabolites for shrimp health management.

The crude extracts of *B. serrulifer* also inhibited the growth of *Escherichia coli* and *Staphylococcus aureus*, indicating broad-spectrum antibacterial activity against both Gram-negative and Gram-positive bacteria. These findings differ slightly from those reported by Duddu et al. (2017), in which *Cellana radiata* extracts showed antibacterial activity predominantly against *Vibrio* harveyi with little or no inhibition of *E. coli* and *S. aureus*. The broader antibacterial spectrum observed in the present study may be attributed to differences in the chemical composition of bioactive metabolites present in marine fish tissues compared with those found in marine gastropods.

The antibacterial activity observed in the present study is also consistent with the findings of Sunil Kumar et al. (2017), who employed bioactivity-guided fractionation of *Anadara granosa* extracts and isolated the novel diglyceride compound 1-(((2Z,4Z)-dodeca-2,4-dienoyl)oxy)-3-hydroxypropan-2-yl tetradecanoate. This purified compound exhibited inhibition zones of 12 mm against *Vibrio* harveyi and 11 mm against *Staphylococcus aureus*, with a minimum inhibitory concentration (MIC) of 32 µg mL^{-1} against V. harveyi. Their study demonstrated that marine bivalves represent valuable sources of bioactive secondary metabolites with potential application in shrimp disease management (Sunil Kumar et al., 2017).

Overall, the findings of the present investigation, together with the studies of Duddu et al. (2017) and Sunil Kumar et al. (2017), provide strong evidence that marine organisms from the Visakhapatnam coast are important reservoirs of biologically active compounds with antibacterial properties. The comparatively higher inhibition zones recorded against *Vibrio parahaemolyticus* in the present study further demonstrate the therapeutic potential of *B. serrulifer* as a natural antimicrobial resource. These observations support the utilization of underexploited marine by-catch species for the development of functional seafood products, natural antimicrobial agents, aquaculture feed additives, and pharmaceutical compounds. Nevertheless, further investigations involving bioassay-guided purification, structural characterization, toxicity evaluation, minimum inhibitory concentration (MIC), minimum bactericidal concentration (MBC), and mechanism-of-action studies are required before commercial applications can be realized.

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