

# Antibacterial activity of muscle extracts of mangrove red snapper from *Lujanus argentimaculatus* against enteric pathogens

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## Abstract

Antibacterial activity of methanolic and acetone muscle extracts of *Lujanus argentimaculatus* against enteric pathogens was tested by standard disc diffusion method. Both the methanolic and acetone muscle extracts showed maximum zone of inhibition against *Staphylococcus aureus* and *Escherichia coli* at 30 µl concentration. It is suggested that the strong antibacterial effect might be due to the antimicrobial peptides present in it.

**Key Words:** Antibacterial activity, *Escherichia*, *Lujanus*, peptides, *Staphylococcus*

## INTRODUCTION

Since earlier civilizations, fishing and seafood consumption have played a significant role in the coastal areas of Tamil Nadu. Seafood products seem to be a healthy diet worldwide. It is one of the good sources of animal protein, poly unsaturated fatty acids (Paramasivam *et al.*, 2013) vitamins viz A, B12, D, E, and minerals like iodine, selenium, calcium, zinc and iron (Mashaii *et al.*, 2012). In recent years, fish has become a favourite foodstuff for the majority of people owing to several health reasons. Fish diet plays a protective role against the development of cardiovascular diseases and rheumatoid arthritis (Kris-Etherton *et al.*, 2003; Tedeschi *et al.*, 2018). This pharmacological activity of fish diet is due to the macromolecules and its derivatives present in it. The mangrove red snapper *Lujanus argentimaculatus* is a large, predatory reef fish belonging to the family Lutjanidae. In Tamil it is called as Sankara. This fish is rich selenium, potassium and omega-3 fatty acids.

It has been recognized as one of the most important aquaculture species.

Enteric or diarrhoeal infections are significant public health issues in developing countries and contribute to the death of 3.3 to 6.0 million children annually. *Salmonella Shigella*, *Proteus*, *Klebsiella*, *Escherichia coli*, *Pseudomonas*, *Vibrio cholera* and *Staphylococcus aureus* are the major etiologic agents of sporadic and epidemic diarrhea both in children and adults (Haniffa *et al.*, 2013). Many diseases were initially controlled by the use of antimicrobial drugs. The over usage of existing antibiotics is a major threat to the medical field due to the emergence of multi drug resistant pathogens (Bandow *et al.*, 2003). There is an urgent need to explore and discover new antimicrobial compounds with diverse chemical structures and novel mechanism of action against new infectious diseases. The rich diversity of marine ecosystem can be explored to discover new pharmacologically bioactive substances. This paper explores the antibacterial activities of muscle extracts of mangrove red snapper *Lujanus argentimaculatus*.

## MATERIALS AND METHODS

### Collection of animal specimen

The fish purchased from the local fish market of Tiruchirappalli district, Tamil Nadu, India were brought to the laboratory and washed well until sand and mud were completely removed from it. The muscle was cut into small pieces rinsed with sterile distilled water, kept in petri dishes, dried at a constant temperature of 50 °C for 24 hrs in a hot air oven and powdered.

### Preparation of muscle extract

Five gram of muscle powder was dissolved in 100 ml of methanol and acetone solvents at 18 °C to prepare 5% of methanolic and acetone muscle extract, respectively. The extracts from the solvent were filtered

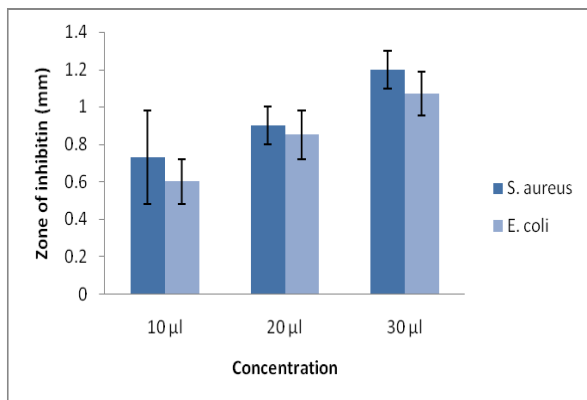


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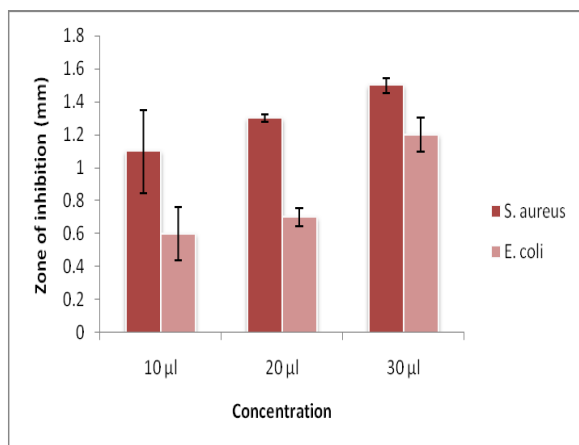
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**Fig. 1.** Antibacterial activity of methanolic extract of muscle of *Lutjanus argentimaculatus*



**Fig. 2.** Antibacterial activity of acetone extract of muscle of *Lutjanus argentimaculatus*

twice using Whatman No.1 filter paper and used for the experiments.

### Antibacterial activity

#### Bacterial cultures

Gram positive bacteria *Staphylococcus aureus* (MTCC 3160) and Gram negative bacteria *Escherichia coli* (MTCC 443) were purchased from Microbial Type Culture Collection (MTCC), Chandrigarh, India. Each strain was sub cultured and maintained at 4<sup>o</sup> C and used to test antibacterial efficacy.

#### Evaluation of Antibacterial activity

Antibacterial activity of the methanolic and acetone muscle extracts were analysed by following the method of Sulaiman *et al.*, (2013). The three different concentrations (10 µl, 20 µl and 30 µl) of 5% extract of the methanolic and acetone extract were tested for antibacterial activity using agar disc diffusion assay.

Sterile discs of six millimeter width had been impregnated with different concentrations of samples

and introduced onto the upper layer of the seeded agar plate. The plates were incubated overnight at 37 °C. Antibacterial activity was assessed by measuring the inhibition zone formed around the discs in millimeter. The experiments were repeated in triplicates and the mean with S.D values were presented.

### Antibiotic sensitivity test on microbes (Positive control)

The antibiotic sensitivity test was analysed using standard antibiotics (Tetracycline for *S. aureus* and Erythromycin for *E. coli*). The sterilized nutrient agar medium was poured into each sterile petri plates and allowed to solidify. By using a sterile cotton swabs, a fresh bacterial culture with known population count was spread over the plates by following spread plate technique. Then the selected standard antibiotic discs were placed on the petri plates and were incubated for 24 hrs at 37° C. The results were observed and the diameter of the inhibition zone measured.

## RESULTS

### Antibacterial activity

The antibacterial activities of methanolic and acetone extracts muscle of *Lutjanus argentimaculatus* are shown in Figures 1 and 2. Both the extracts had efficient antibacterial activity against the pathogens (Figures 1 and 2). The zone of inhibitions ranged from 0.6 to 1.5 mm. Both the extracts showed maximum activity at 30 µl concentration.

## DISCUSSION

Among the fish by-products, fish mucus, gills and blood is considered more valuable and has been reported to contain several antimicrobial proteins (Kumar *et al.*, 2012). Most of the antimicrobial peptides kill bacteria by a common mechanism, which involves direct electrostatic interactions with negatively charged phospholipids on microbial cell membranes followed by physical disruption and solubilization. Fish contain naturally occurring proteins and glycoproteins of non-immunoglobulin nature (transferrins, metallothionein) that react with environmental antigens and confer an undefined natural immunity to fish. Hence, several endogenous peptides with antimicrobial activity have been purified from fish especially from the skin and intestinal mucus.

In the present study, we have screened the antibacterial activity of mangrove red snapper fish *Lutjanus argentimaculatus* against two enteric bacterial strains with 5% methanolic and acetone extract of three different (10 µl, 20 µl and 30 µl) concentrations. The antibacterial activity of methanolic muscle extract at 30 µl concentration showed zone of inhibition as 1.20

mm and 1.07 mm against *S. aureus* and *E. coli* respectively. The acetone extract at 30 µl concentration showed maximum zone of inhibition as 1.51 mm against *S. aureus* and 1.36 mm against *E. coli*. Several antimicrobial studies have been done earlier using the mucus of fishes and their tissue extracts. Kumaravel *et al.*, (2011) have shown maximum antimicrobial effect against *S. aureus* by liver extract and antibacterial effect against *Vibrio cholera* by skin extract of Puffer fish *Arothron immaculatus*. Five crude extracts from four *Channa* species showed maximum zone of inhibition as 12.6 mm for the methanol extract of *C. striatus* against *Shigella dysenteriae* (Haniffa *et al.*, 2013). Mohana Priya *et al.*, (2013) have screened the crude tissue extracts (Liver, Muscle, skin) of *A. hispidus* against seven human pathogenic bacteria for antibacterial activities. They observed maximum zone of inhibition 12.8 mm against the *E. coli* by the skin extract of *A. hispidus* and the minimum zone 9.60 mm against *P. vulgaris* by the liver extract. Anbuhezhan *et al.*, (2011) have studied the spectrum of antibacterial activity of the mucus of estuarine cat fish *A. maculatus* and observed maximum (8 mm) against *E. coli* and minimum (6.5 mm) zone of inhibition against *K. pneumoniae*.

## CONCLUSION

The fish *L. argentimaculatus* can be used as supplements to patients especially those with protein deficiency. As per the nutritional status concerned it is a commercially sound species and further research should focus on the amino acids and fatty acids profile which will be beneficial to mankind. Also, the antibacterial efficacy of the tissue extract showed it can be used as natural antimicrobial agent replacing synthetic antibiotics.

## REFERENCES

- Anbuhezhan, R., Gobinath, C., and Ravichandran, S. 2011. Antimicrobial peptide from the epidermal mucus of some estuarine cat fishes. *World Appl. Sci. J.*, 12: 256-260.
- Bandow, J. E., Brötz, H., Leichert, L. I. O., Labischinski, H., and Hecker, M. 2003. Proteomic approach to understanding antibiotic action. *Antimicrob Agents Chemother*, 47(3): 948-955. PMID:12604526 PMCID:PMC149304 <https://doi.org/10.1128/AAC.47.3.948-955.2003>
- Haniffa, M. A., Jeyasheela, P., and Milton, M. J. 2013. *In vitro* antibacterial activity of tissue extracts from four channids against enteric pathogens. *J. Agric. Sci. Technol.*, 9(6):1437-1445.
- Kris-Etherton, P. M., Harris, W. S., and Appel, L. J. 2003. Omega-3 fatty acids and cardiovascular disease: New recommendations from the American Heart Association. *Arterioscler Thromb Vasc Biol.*, 23(2): 151-152. PMID:12588750 <https://doi.org/10.1161/01.ATV.0000057393.97337.AE>
- Kumar, N. P., Marimuthu, K., Rao, R. V., Xavier, R., Kathiresan, S., Suresh, C. V., and Sreeramanan, S. 2012. Antimicrobial activity of different tissues of snakehead fish *Channa striatus* (Bloch). *Asian Pac. J. Trop. Dis*, 2: 302-305. [https://doi.org/10.1016/S2222-1808\(12\)60170-4](https://doi.org/10.1016/S2222-1808(12)60170-4)
- Kumaravel, K., Ravichandran, S., Joseph, F. S., Manikodi, D., and Doimi, M. 2011. *In vitro* antimicrobial activity of tissue extracts of puffer fish *Arothron immaculatus* against clinical pathogens. *CJNM*, 9(6): 446-449.
- Mashaii, N., Mosaddegh, M. H., Sarsangi, H., Rajabipour, F., Ghorghi, A., Bitaraf, A., and Mozaffari Khosravi, H. 2012. Proximate and fatty acid composition in muscle tissues of Rainbow Trout, *Oncorhynchus Mykiss*, Cultured in Yazd Province of Iran. *Walailak J Sci and Tech*, 9(4): 317-325.
- Mohana, P. K., and Khora, S. S. 2013. Antimicrobial, hemolytic and cytotoxic activities of the puffer fish *Arothron hispidus* from the Southeast coast of India. *Int. J. Drug Dev. Res.*, 5(2): 317-322.
- Paramasivam, S., Thiyagarajan, S. P., and Balachandar, B. 2013. Inhibitory activity of ink and body tissue extracts of *Euprymna Stenodactyla* and Octopus *Dollfusii* against histamine producing bacteria. *Middle East J. Sci. Res*, 16(4):514-518.
- Sulaiman, G. M. 2013. Antimicrobial and cytotoxic activities of methanol extract of *Alhagi maurorum*. *Afr. J. Microbiol. Res*, 7(16): 1548-1557. <https://doi.org/10.5897/AJMR12.1795>
- Tedeschi, S. K., Bathon, J. M., Giles, J. T., Lin, T.-C., Yoshida, K., and Solomon, D. H. 2018. Relationship between fish consumption and disease activity in rheumatoid arthritis. *Arthrit Care Res*, 70(3): 327-332. <https://doi.org/10.1002/acr.23295> PMID:28635117 PMCID:PMC5740014