



International Journal of Zoology, Environment and Life Sciences

Content Available at www.lapinjournals.com ISSN (O): 2048-9598
(An International online peer reviewed Referred Journal)



Short Communication

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A COMPARATIVE STUDY OF THE PROXIMATE COMPOSITION OF MALE AND FEMALE YELLOWFIN TUNA (*THUNNUS ALBACARES*) OFF THE VISAKHAPATNAM COAST, INDIA

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Article History: Received: 24 Nov 2025, Revised: 04 Dec 2025, Accepted: 07 Jan 2026

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DOI: <https://doi.org/10.70604/ijzels.v3i1.127>

Abstract

The present study evaluates and compares the proximate composition of muscle tissue in male and female yellowfin tuna (*Thunnus albacares*) collected from the Visakhapatnam coast, eastern India. Biochemical constituents such as moisture, protein, lipid, and carbohydrate were analyzed using standard analytical methods. Results revealed noticeable sex-based variations in muscle composition. Female tuna exhibited marginally higher lipid and moisture content, whereas male tuna showed relatively higher protein concentration. Carbohydrate content remained low and comparable in both sexes. These differences are attributed to physiological and reproductive energy allocation patterns. The findings highlight the importance of sex-based nutritional assessment for fisheries management, processing strategies, and value-added product development.

Keywords: Yellowfin tuna, proximate composition, male and female comparison, nutritional profile, Visakhapatnam coast

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INTRODUCTION

Yellowfin tuna (*Thunnus albacares*) is one of the most commercially significant oceanic pelagic species, widely distributed in tropical and subtropical waters of the Indian Ocean. Along the east coast of India, particularly off Visakhapatnam, yellowfin tuna supports an emerging fishery primarily exploited by traditional hook-and-line methods [1,2].

Fish muscle composition is influenced by intrinsic factors such as sex, size, and reproductive stage, as well as extrinsic factors including season and habitat [3]. Several studies have reported that female fishes often accumulate higher lipid reserves to meet the energetic demands of gonadal development, whereas males may retain higher protein levels associated with muscle mass and activity [4,5].

Although earlier investigations have documented the general biochemical composition of *T. albacares* in Indian waters [6–8], comparative data on male and female proximate composition from the Visakhapatnam coast

remain limited. The present study aims to address this gap by evaluating sex-wise variations in muscle biochemical composition and discussing their biological and nutritional implications.

MATERIALS AND METHODS

Sample Collection and Sex Identification

Fresh specimens of *Thunnus albacares* were collected from Visakhapatnam fishing harbor during February 2024. Sex was determined by visual examination of gonads. Only mature male and female individuals of comparable size range were selected for analysis.

Sample Preparation

Muscle tissue from the dorsal region was excised, washed, and processed for biochemical analysis. All estimations were carried out in triplicate, and results were expressed as percentage of wet weight.

Biochemical Analysis

- **Moisture:** Oven drying method
- **Protein:** Lowry et al. method [9]

- **Carbohydrate:** Anthrone method [10]
- **Lipid:** Bligh and Dyer extraction method [11]

RESULTS

Sex-wise Proximate Composition

The proximate composition of male and female yellowfin tuna muscle tissue is presented in Table 1. Clear differences were observed between the sexes.

Table 01: Comparative proximate composition (%) of male and female *Thunnus albacares*

Component	Male (%)	Female (%)
Moisture	72.8	74.4
Protein	24.3	22.9
Lipid	1.6	2.2
Carbohydrate	0.3	0.3

Male tuna exhibited higher protein content (24.3%) compared to females (22.9%), while females showed higher moisture and lipid content. Carbohydrate levels were minimal and identical in both sexes.

DISCUSSION

Moisture

Moisture content was slightly higher in female yellowfin tuna compared to males. This inverse relationship between moisture and lipid content is well documented in fish muscle [12]. Increased moisture in females may be linked to metabolic and reproductive processes, particularly during gonadal maturation.

Protein

Protein content was higher in male tuna, indicating greater muscle protein deposition. Similar sex-related differences have been reported in tuna and other pelagic fishes [13,14]. Higher protein concentration in males may be associated with sustained swimming activity and lower diversion of energy toward reproductive tissue development.

Lipid

Female tuna exhibited higher lipid content than males. Lipid accumulation in females is a common physiological strategy to support oogenesis and spawning [15]. Earlier studies on yellowfin and bigeye tuna have also reported elevated lipid levels in females, especially during pre-spawning periods [16].

Carbohydrates

Carbohydrates constituted a negligible fraction (0.3%) in both sexes, which is consistent with previous reports indicating that fish rely primarily on proteins and lipids for energy metabolism rather than carbohydrates [17].

Overall, the sex-wise variations observed in the present study are consistent with earlier findings and reflect normal physiological differences in energy allocation between male and female tuna.

CONCLUSION

The present investigation demonstrates clear sex-based differences in the proximate composition of yellowfin tuna from the Visakhapatnam coast. Male tuna are characterized by higher protein content, while females exhibit increased lipid and moisture levels. These variations have important implications for nutritional evaluation, processing yield, and product development. Incorporating sex-specific biochemical data into tuna fishery assessments can enhance resource management strategies and optimize utilization of this economically valuable species.

ACKNOWLEDGEMENT

Not Declared

CONFLICTS OF INTEREST

The author declares no conflicts of interest.

FINANCIAL SUPPORT

None

ETHICAL CONSIDERATIONS AND INFORM CONSENT

Not Applicable

AUTHOR CONTRIBUTION

Both are contributed equally.

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