Indonesian Journal of Pharmaceutical and Clinical Research
Journal homepage: https://idjpcr.usu.ac.id

IDENTIFICATION AND CHARACTERIZATION OF ANCHOVY (*Stolephorus commersonnii*) PRODUCED IN TANJUNG TIRAM VILLAGE BATU BARA REGENCY

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ARTICLE INFO

Article history:
Received 24 April 2025
Revised 05 June 2025
Accepted 12 June 2025
Available online 13 June 2025

E-ISSN: 2620-3731
P-ISSN: 2615-6199

How to cite:
Rexi, D., Pintaui, S., Dalimunthe, A., & Nasri, N. (2025). Identification and characterization of anchovy (Stolephorus commersonii) produced in Tanjung Tiram Village Batu Bara Regency. *Indonesian Journal of Pharmaceutical and Clinical Research*, 08(01), 001–006.

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http://doi.org/10.32734/idjpcr.v8i01.20636

ABSTRACT

Anchovy is a widely consumed marine food source in Indonesia and has the potential to serve as a vital nutritional resource. This study aimed to analyze the primary nutrient contents of anchovy, including protein, total fat, phosphorus, calcium, and iron levels. Nutritional composition analysis was conducted through laboratory testing using scientifically validated standard methods. The results were analyzed descriptively to provide an overview of the chemical composition of anchovy. The findings revealed that anchovy contains 31.5% protein, indicating its value as a rich source of animal protein. The total fat content was measured at 4.76%, suggesting a relatively low to moderate fat level. Furthermore, phosphorus content was recorded at 227.8 mg/kg, calcium at 2.45%, and iron at 36.1 mg/kg—all essential minerals for physiological functions. Based on these results, anchovy demonstrates strong potential as a highly nutritious local food source that could significantly contribute to meeting the community's nutritional needs.
Keyword: Anchovy, Calcium, Phosphorus, Protein, Fat.

ABSTRAK

Ikan teri merupakan sumber pangan laut yang banyak dikonsumsi di Indonesia dan memiliki potensi sebagai sumber nutrisi penting. Penelitian ini bertujuan untuk menganalisis kandungan zat gizi utama dalam ikan teri, meliputi kadar protein, lemak total, fosfor, kalsium, dan zat besi. Analisis komposisi nutrisi dilakukan melalui pengujian laboratorium dengan metode standar yang telah tervalidasi secara ilmiah. Hasil pengujian dianalisis secara deskriptif untuk memberikan gambaran mengenai komposisi kimia ikan teri. Hasil penelitian menunjukkan bahwa ikan teri mengandung protein sebesar 31,5%, yang menunjukkan nilainya sebagai sumber protein hewani yang kaya. Kandungan lemak total sebesar 4,76% menunjukkan kadar lemak yang relatif rendah hingga sedang. Selain itu, kandungan fosfor tercatat sebesar 227,8 mg/kg, kalsium sebesar 2,45%, dan zat besi sebesar 36,1 mg/kg—seluruhnya merupakan mineral penting bagi fungsi fisiologis tubuh. Berdasarkan hasil ini, ikan teri menunjukkan potensi besar sebagai sumber pangan lokal yang bergizi tinggi dan dapat berkontribusi signifikan dalam memenuhi kebutuhan gizi masyarakat.
Kata kunci: Ikan teri, Kalsium, Fosfor, Protein, Lemak

1. Introduction

Indonesia's marine fisheries resources can generally be categorized into three main groups: small pelagic fish, large pelagic fish, and demersal fish. Among these, small pelagic fish make a significant contribution to national fishery potential. Anchovy is one of the most commonly found species in this group and serves as an important commodity for fulfilling the dietary needs of the community, particularly as a source of animal protein.

The abundant availability of anchovy highlights its strategic role in the capture fisheries sector. According to the Directorate General of Fisheries, anchovy production in Indonesia reached 175,726 tons in

2010, with an estimated value of approximately 2.16 trillion rupiahs. Production had increased to 199,226 tons, indicating substantial growth in this commodity's output [1].

Given this significant potential, there is a need for more targeted development and processing efforts to support improvements in the welfare of coastal communities. One strategic approach is to optimize the utilization of small pelagic fish catches, especially anchovy, which is typically processed into dried products using traditional sun-drying methods. However, the quality of these traditional products often varies due to inconsistent post-harvest handling, highlighting the need for quality improvement and product diversification to enhance the added value of anchovy-based products [2].

Improving the quality and safety of traditional fishery products depends heavily on proper supervision and handling at every stage of processing, from catch to final consumer product. Therefore, observational studies and product characterization are necessary—particularly for anchovy products produced in coastal villages such as Tanjung Tiram in Batu Bara Regency—to provide scientific foundations for quality enhancement and the development of value-added fishery products [2].

1. Methods

2.1 Materials

The primary material used in this study was anchovy, obtained from local fishers in Tanjung Tiram Village, Batu Bara Regency, North Sumatra, Indonesia. All reagents and analytical materials used for chemical and nutritional analysis were of analytical grade and conformed to standardized laboratory requirements [3].

2.2 Species Identification

Identification was carried out at the Animal Systematics Laboratory, Faculty of Mathematics and Natural Sciences, Universitas Sumatera Utara. Identification was based on morphological characteristics and confirmed using standard taxonomic references [4].

2.3 Chemical and Nutritional Content Analysis

The chemical composition of anchovy was analyzed at the Medan Research and Industry Standardization Center (BARISTAND). Proximate composition analysis included the following parameters:

a. Protein content: Determined using the Kjeldahl method (AOAC 2005, Method 981.10) [18]
b. Total fat content: Determined using Soxhlet extraction (AOAC 2005, Method 963.15) [18]
c. Phosphorus, calcium, and iron content: Measured using Atomic Absorption Spectrophotometry (AAS), following validated laboratory protocols [5].

3. Results and Discussion

3.1 Species Identification

Based on the laboratory analysis conducted by the Animal Systematics Laboratory, Faculty of Mathematics and Natural Sciences, Universitas Sumatera Utara, with reference number: 25/UN5.2.1.11/KRK/2024, exhibits the following characteristics of anchovy : a maximum length of 7-8 cm, body height of 1-2 cm, and light brown transparent body coloration. The body was somewhat flattened with a slightly rounded abdomen, lacking anal fin spines. The anal fin was soft with 21-22 rays, and 0-5 small needle-like scales were observed in the abdominal region. Additional features included a sharp upper jaw extending to or slightly beyond the posterior boundary of the pre-operculum, 23-28 dorsal fin rays, small teeth along the upper hyoid bone, and evenly distributed myomere muscle tissue. The ventral fin extended beneath the anterior dorsal fin, while the anal fin exhibited 3 unbranched and 18-19 branched rays.

These features align with the diagnostic characteristics of *Stolephorus commersonnii*, a small pelagic species belonging to the family Engraulidae. This confirms that the specimens used in this study were indeed anchovies of the *Stolephorus* genus. Taxonomic classification is shown in bellow:

Anchovy Classification

Kingdom	:	Animalia
Phylum	:	Chordata
Class	:	Pisces
Order	:	Clupeiformes
Family	:	Engraulidae
Genus	:	*Stolephorus*
Species	:	*Stolephorus commersonnii*

Species identification is a critical step in biological and nutritional studies as it ensures the accuracy of species-specific nutritional profiling. Misidentification could result in misleading conclusions regarding nutritional value and public health implications [9].

3.2 Chemical and Nutritional Composition of Anchovy

Based on test results from the Medan Research and Industry Standardization Center (BARISTAND), with certificate number: 1257/BSKJI/BSPJI-Medan-MS-P/VI/2024, the nutritional components of *Stolephorus commersonnii* were quantified (Table 1).

Table 1. Chemical Content in Anchovy

Parameter	Test Result	Test Method
Protein content	31.5 %	SNI-01-2891-1992
Total fat content	4.76 %	SNI-01-2891-1992
Phosphorus content	227.8 mg/kg	SNI-01-2891-1992
Calcium content	2.45 %	AAS
Iron content	36.1 mg/kg	AAS

Protein Content

Anchovy (*Stolephorus commersonnii*) is a marine commodity widely recognized for its dense nutritional composition, particularly its high protein content. Laboratory analysis in this study revealed that anchovy contains a protein level of 31.5%, classifying it as a high-protein food source. This value exceeds previously reported levels in similar studies. For instance, Fahmi et al. recorded a protein content of 27.78% in dried anchovy, highlighting the relatively higher nutritional potential identified in the current analysis [3]. The observed variation in protein content across studies can be attributed to several contributing factors. These include differences in anchovy species, seasonal variation in fish capture, post-harvest handling, processing methods (such as drying or salting), and the analytical techniques employed for nutritional evaluation. Notably, a study by Sutarno reported a much lower protein content of 3.72%, indicating significant variability that underscores the importance of standardizing measurement protocols and ensuring precise species identification in nutritional assessments [4].

Anchovy high protein level supports its role as a valuable dietary component, especially in contexts where access to conventional animal protein sources (such as red meat) is limited. As an animal-based protein, anchovy offers a complete amino acid profile and high digestibility, making it an ideal candidate for use in nutritional intervention programs [7]. Protein is crucial for maintaining multiple physiological functions, including the formation and repair of tissues, enzymatic activity, hormone synthesis, and immune system performance [5], [16].

Total Fat Content

Laboratory analysis revealed that the total fat content in anchovy was 4.76%, classifying it as a medium-fat fish. This value is notably higher than that reported in previous studies. Fahmi, for example, found a fat content of only 1.95% in anchovies [3], while Sormin reported a fat content of 3.66% in anchovy species dried using cabinet dryers [6]. These differences suggest that the fat content in anchovy can be significantly influenced by several factors, including species variation, fishing location, seasonal changes, feed availability, and most notably, the processing and drying techniques applied post-harvest. Although small pelagic fish are generally characterized by their low fat content, the result of this study highlights that *Stolephorus commersonnii* may serve as a more substantial source of healthy fats. This is particularly relevant in relation to omega-3 fatty acids, which are known to contribute to cardiovascular health by lowering triglyceride levels and reducing inflammation [11]. The elevated fat level, therefore, not only enhances the nutritional value of anchovy but also supports its role as a functional food ingredient in both community nutrition and commercial food development [12]. In addition to its well-known role as a source of protein and minerals—especially calcium due to the practice of consuming the fish whole—anchovy fat content also warrants attention for its bioactive potential. The presence of beneficial lipids in moderate amounts makes anchovy a promising candidate for use in functional food products, nutritional interventions, or as a processed fish ingredient with added health value [2].

Phosphorus Content

Anchovy (*Stolephorus commersonnii*) is a nutrient-dense wild-caught fish, rich in both macro- and micronutrients. One of the key minerals found in anchovy is phosphorus, which is essential for numerous

physiological processes, particularly in bone formation, cellular repair, and energy metabolism through its role in adenosine triphosphate (ATP) production. Laboratory analysis in this study revealed that the phosphorus content of anchovy reached 227.8 mg/kg, classifying it as a moderately rich source of this mineral. This finding reinforces anchovy's nutritional significance, particularly in supporting dietary phosphorus intake in vulnerable groups such as children and the elderly, who are at higher risk of mineral deficiencies [13]. Phosphorus is a critical component of hydroxyapatite ($Ca_{10}(PO_4)_6(OH)_2$), the primary inorganic compound responsible for the formation and structural integrity of bones and teeth. Together with calcium, phosphorus maintains the mineral density and strength of hard tissues, making adequate intake of both minerals essential for skeletal development and oral health [2].

In the context of dental health, phosphorus plays a vital role in the remineralization process—a natural defense mechanism wherein minerals such as phosphate and calcium are redeposited into tooth enamel that has been demineralized by acidic by-products from cariogenic bacteria. This dynamic equilibrium between demineralization and remineralization is crucial in preventing dental caries [5]. Furthermore, phosphorus supports the metabolic function of vitamin D, which regulates the intestinal absorption of both calcium and phosphate. Insufficient phosphorus intake may impair hydroxyapatite synthesis, compromising enamel and dentin strength and increasing susceptibility to carious lesions. Given its relatively high phosphorus content, anchovy can serve as a functional dietary source to help meet daily mineral requirements. This is especially beneficial when anchovies are consumed whole, as it ensures maximal mineral retention [23]. Beyond its protein and fat content, anchovy also offers considerable mineral contributions, supporting its development as a raw material for nutrient-enriched processed food products with broad applications in community nutrition and public health initiatives [6].

Calcium Content

Calcium is a vital macromineral involved in numerous physiological functions, including bone mineralization, muscle contraction, nerve impulse transmission, and blood coagulation. In the context of oral health, calcium is a primary constituent of hydroxyapatite crystals that form the structural basis of enamel and dentin. The availability of calcium is essential not only for skeletal development but also for enamel remineralization, a natural defense mechanism against tooth demineralization and dental caries [22].

This study revealed that the calcium content in anchovy was 2.45%, or 24,500 mg/kg, which is significantly higher than values reported in previous literature. For comparison, Regar reported a calcium content of 575 mg/kg, Khairunisa found 298.91 mg/kg [14], and Saputri reported 1.06%. This striking discrepancy may be attributed to several influencing factors, such as species differences, sampling sites, environmental mineral concentrations [e.g., calcium content in seawater], post-harvest processing methods, analytical techniques, and most notably, whether or not the entire fish—including bones—was homogenized and analyzed. The inclusion of bones, known to be rich in calcium, likely contributes substantially to the elevated levels observed in this study. The high calcium concentration positions anchovy as an excellent natural source of dietary calcium, especially in communities where dairy consumption is limited due to economic, cultural, or lactose intolerance-related reasons [17]. Regular consumption of dried anchovy, particularly when eaten whole, may serve as an effective strategy for addressing calcium deficiency and preventing associated conditions such as osteoporosis [15].

Furthermore, in oral health applications, calcium supports the remineralization of tooth enamel following acid-induced demineralization. Tooth enamel, the hardest substance in the human body, is composed of approximately 96% inorganic material—primarily hydroxyapatite ($Ca_{10}(PO_4)_6(OH)_2$) [21]. Under acidic conditions, calcium and phosphate ions are leached from the enamel surface. Remineralization can occur if these ions are reintroduced through saliva or diet. Calcium-rich foods, such as anchovies, thus play a supportive role in maintaining enamel integrity and resisting cariogenic damage [10].

Iron Content

Iron is a critical micromineral required for various essential physiological functions, including oxygen transport via hemoglobin, DNA synthesis, cellular respiration, and enzymatic activity in redox reactions. Its deficiency—manifesting primarily as iron-deficiency anemia—remains a prevalent global health concern, particularly among women of reproductive age, infants, and young children in low- and middle-income countries [19]. In this study, the iron content of anchovy was measured at 36.1 mg/kg, which is markedly higher than previously reported values. For instance, Hendrayati recorded an iron content of 5.82 mg/kg, while Litaay found only 3.9 mg/kg [6], [7]. These substantial differences may be attributed to multiple factors, including variation in fish species, environmental iron availability in the habitat, seasonal differences in fish

physiology, post-harvest handling, and differences in analytical methodologies. Additionally, the inclusion of blood-rich tissues or internal organs in homogenized samples may elevate iron concentrations.

This elevated iron content underscores the potential of anchovy as a potent local food-based source of dietary iron. Regular consumption of iron-rich foods such as anchovy can significantly contribute to fulfilling daily iron requirements and serve as a practical intervention in communities with high anemia prevalence. From a public health nutrition perspective, promoting the integration of anchovy into daily meals, particularly in regions with limited access to red meat or iron-fortified foods, may serve as a low-cost, culturally acceptable strategy to reduce anemia incidence. Moreover, the high iron content enhances the value of anchovy not only nutritionally but also economically. Its potential use as a raw material in the development of fortified or functional food products—such as anchovy powder, seasoning blends, or complementary weaning foods—could increase market demand and consumer acceptance [20]. This dual benefit strengthens the case for anchovy as both a health-promoting ingredient and a commodity with increased marketability for small-scale fisheries and local industries.

4. Conclusion

The analysis confirms that *Stolephorus commersonnii* from Tanjung Tiram is not only morphologically well-identified but also exhibits a high nutritional profile, making it a valuable marine resource. With 31.5% protein, 4.76% total fat, 2.45% calcium, 227.8 mg/kg phosphorus, and 36.1 mg/kg iron, anchovy qualifies as a high-nutrient fishery commodity. These values underscore its potential as an accessible source of high-quality animal protein and essential micronutrients—particularly calcium and iron—that are crucial for bone health, oxygen transport, and cellular metabolism. Given its nutrient density and local availability, anchovy presents a strategic opportunity for use in functional food formulations, dietary diversification programs, and the development of value-added processed products aimed at addressing malnutrition and supporting public health, especially in communities with limited access to conventional protein and mineral sources.

5. Conflict of Interest

All authors declare that they have no conflict of interest related to this study and its publication.

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