International Journal of Contemporary Sciences (IJCS)
Vol. 4, No. 7, 2026: 1981-1994

Proximate Composition and Utilization Potential of Jellyfish as a Sustainable Marine Resource: A Systematic Literature Review

Lady Ayu Sri Wijayanti[1*], Gilar Budi Pratama[2], Tito A Nugraha[3], Mukhlisnah Djalil[4], Mochamad Ramdhan Firdaus[5]
[1,2]Faculty of Fisheries and Marine Sciences, Department of Fisheries, Padjadjaran University, Jatinangor, West Jawa, Indonesia
[3]Department of Aquatic Resources Management, Faculty of Marine Science and Fisheries, Universitas Maritim Raja Ali Haji, Tanjungpinang, Riau Islands, Indonesia
[4]Faculty of Maritime, Fisheries, and Forestry Sciences, Universitas Nahdlatul Ulama Gorontalo, Gorontalo, Indonesia
[5]Research Center for Biota Systems, National Research and Innovation Agency (BRIN), Cibinong, Indonesia
Corresponding Author: Lady Ayu Sri Wijayanti lady@unpad.ac.id

A R T I C L E I N F O

Keywords: Jellyfish, Proximate Analysis, Nutritional Composition, Marine Resources, Systematic Literature Review

Received : 10 May
Revised : 15 June
Accepted: 30 July

A B S T R A C T

Jellyfish (Scyphozoa) represent an underutilized marine resource despite their high nutritional and biofunctional potential. This study aims to evaluate the proximate composition, nutritional characteristics, effects of processing methods, and the potential utilization of jellyfish through a Systematic Literature Review (SLR) approach. The literature search was conducted using the Semantic Scholar and Google Scholar databases, with article selection based on the PRISMA guidelines. From 25 initially identified articles, 7 articles met the inclusion criteria and were selected for analysis. The review results indicate that jellyfish contain proteins, collagen, amino acids, taurine, and potential bioactive compounds; however, their nutritional profiles are strongly influenced by species differences and processing methods. Drying processes can increase nutrient concentration, while salting may increase ash content due to mineral accumulation. This review highlights the potential of jellyfish as a sustainable raw material for applications in the food industry, aquaculture, cosmetics, and biotechnology

DOI: https://doi.org/10.55927/tgvq2028
E-ISSN: 3047-4078
https://journalijcs.my.id/index.php/ijcs

INTRODUCTION

The exploration of underutilized marine resources has emerged as an important pillar in supporting global food security and the development of blue economy-based industries. Among various marine commodities, jellyfish (class Scyphozoa) have recently gained substantial attention from researchers and industrial stakeholders (Yusuf et al., 2020). Historically, jellyfish blooms resulting from climate change and overfishing have often been regarded as ecological disasters that negatively impact capture fisheries, tourism, and coastal infrastructure (Jabbar et al., 2023). However, over time, a significant paradigm shift has occurred; this abundant biomass is no longer viewed merely as a nuisance but rather as a high-value biological resource with the potential to support various future industrial sectors.

Traditionally, several jellyfish species have long been consumed as food products in Asian regions due to their unique texture and perceived health benefits (Rahmah & Zakaria, 2017; Yusuf et al., 2020). In the context of modern science, the potential applications of jellyfish have been explored more extensively, encompassing pharmaceutical industries, cosmetics, human nutrition, and their utilization as raw materials for aquaculture feed (aquafeed). This multisectoral potential is closely associated with their biochemical composition. Although fresh jellyfish biomass consists predominantly of water, the dry matter matrix contains various essential macronutrients and secondary metabolites, including structural proteins (collagen) (Nurjanah et al., 2013), essential amino acids, specific fatty acids, and bioactive compounds with antibacterial and therapeutic properties.

Despite their remarkable potential, jellyfish utilization faces significant challenges related to post-harvest handling. The high water content in jellyfish tissues makes them highly susceptible to microbial degradation and autolysis shortly after harvesting. Therefore, the application of preservation and drying technologies is essential to extend shelf life while simultaneously concentrating their nutritional value (Anwar et al., 2026). Various processing methods, ranging from traditional techniques such as repeated salting (salt-drying) to modern approaches such as freeze-drying, have been continuously developed. However, each physical and chemical treatment method ultimately induces significant modifications to the final proximate profile of jellyfish, affecting protein retention, fluctuations in ash content due to mineral residues, and the stability of bioactive compounds.

Proximate analysis and bioactive compound characterization are fundamental parameters for determining the suitability of jellyfish as industrial raw materials (Racero-Galaraga et al., 2024). Although numerous studies have independently investigated the nutritional profiles and bioactivities of jellyfish, the existing literature remains highly fragmented. Most studies tend to focus on individual species from specific geographical regions or emphasize only particular functional aspects, resulting in limited cross-species comparisons and an incomplete understanding of how processing conditions influence the quality of final products.

Based on this identified research gap, this article aims to comprehensively review the chemical profiles and application potential of various jellyfish species. Through the compilation of proximate composition data and the synthesis of findings from previous studies, this review is expected to provide an integrated understanding of jellyfish nutritional characteristics and their prospects for sustainable utilization across various strategic industrial sectors.

LITERATURE REVIEW

Traditionally, several jellyfish species have long been consumed as food products in Asian regions due to their unique texture and perceived health benefits (Rahmah & Zakaria, 2017; Yusuf et al., 2020). In the context of modern science, the potential applications of jellyfish have been explored more extensively, encompassing pharmaceutical industries, cosmetics, human nutrition, and their utilization as raw materials for aquaculture feed (aquafeed). This multisectoral potential is closely associated with their biochemical composition. Although fresh jellyfish biomass consists predominantly of water, the dry matter matrix contains various essential macronutrients and secondary metabolites, including structural proteins (collagen) (Nurjanah et al., 2013), essential amino acids, specific fatty acids, and bioactive compounds with antibacterial and therapeutic properties.

METHODOLOGY

The systematic approach employed in this study was based on the Systematic Literature Review (SLR) method. This method involved two primary processes, namely the systematic review and identification of literature based on predetermined guidelines (Pati & Lorusso, 2018; Arham & Dimyati, 2024). The literature searching and collection process was supported by the reference management software Harzing's Publish or Perish (Baumberg, 2018).

The literature collection process was conducted by searching scientific articles published online. Based on the software settings, the search was focused on two major academic databases, namely Semantic Scholar and Google Scholar. The search keywords were specifically formulated to identify relevant literature related to the nutritional composition and proximate analysis of jellyfish commodities. The details of the keywords and databases used are presented in Table 1.

Table 1. Search Process Used for Data Collection

Data Retrieval Database	Search Keywords
Semantic Scholar	("proximat gizi ubur ubur" OR "kandungan gizi ubur-ubur" OR "komposisi kimia ubur-ubur") ("jellyfish proximate analysis" OR "jellyfish nutritional composition")
Google Scholar	Allintitle: "gizi" AND "ubur-ubur" Allintitle: "proksimat" AND "ubur-ubur" Allintitle: "edible jellyfish" AND "nutrition"

To ensure the relevance of the selected literature, this study adopted the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework for the article selection process (Moher et al., 2009; Assar et al., 2016).

The selection process from the initial 25 documents to the final 7 documents was divided into the following four stages:

1. Identification: This stage involved the initial collection of documents from the selected databases. A total of 25 articles were identified at this stage.
2. Screening: During this stage, duplicate articles across databases were identified and removed. A total of 3 duplicate articles were found, leaving 22 articles for further screening. Subsequently, the titles and abstracts were assessed for relevance. Ten articles were excluded because their topics were outside the scope of this study.
3. Eligibility: The remaining 12 articles were downloaded and evaluated through full-text assessment. At this stage, 5 articles were excluded because they did not provide complete quantitative proximate composition data or were review papers rather than original research articles.
4. Included: Based on the rigorous screening and eligibility assessment, a final total of 7 articles were considered relevant for data extraction and further analysis in this study.

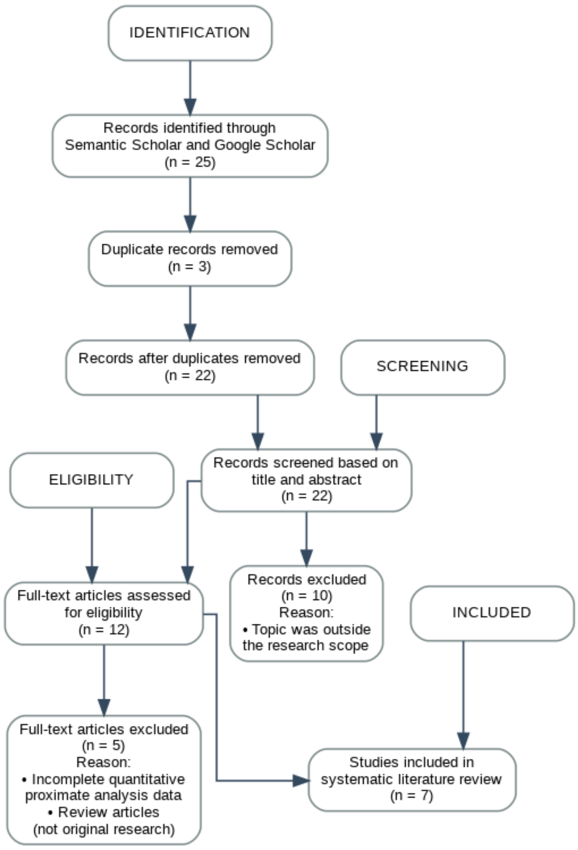

Figure 1. PRISMA Flowchart

RESEARCH RESULT

The compilation and data extraction from previous studies regarding nutritional parameters, chemical composition, and key findings of several jellyfish species are presented in Table 2. Based on the table, previous research can be categorized into three main focus areas: proximate analysis and basic nutritional assessment, identification of bioactive compounds for potential applications, and evaluation of processing methodologies.

Table 2. Literature review on the nutritional parameters and key findings of several jellyfish species.

	Species	Main Parameter	Key Findings
		Author (Year)	
Muthmainnah (2007)	*Bougainvillia* sp.	Alkaloid Compounds	Identified alkaloid compounds with bactericidal activity against *Vibrio* in fish.
Nurjanah *et al.* (2013)	*Aurelia aurita*	Proximate, Amino Acids, Vit B12	High protein (35.63% db) and taurine (2.68% db) content in fresh samples
Kogovšek *et al.* (2014)	*Aurelia aurita*, etc.	Methodology & Chemical Composition	Freeze-drying preserves nitrogen and carbon profiles better than ovendrying.
Yusuf *et al.* (2020)	*Crambione mastigophora*	Economic Potential & Collagen	Red jellyfish is rich in collagen (2.1–10.3 mg/g), suitable for cosmetic raw materials.
Abdiani *et al.* (2022)	*Rhizostoma pulmo*	Proximate (Fresh vs. Dried)	The drying process significantly increases ash content due to salt addition.
Bragadeeswaran *et al.* (2024)	*Lychnorhiza malayensis*	Proximate Analysis & Toxicity	High protein (24.28 g/100g) and exhibits no hemolytic activity.
Guttuso *et al.* (2025)	Various Scyphozoa	Aquafeed Nutrition Review	Potential ingredient for aquafeed due to high ARA and feeding attractant amino acids.

(Note: db = dry basis)

1. Proximate Parameters and Basic Nutritional Profiles

Several studies have reported high protein profiles in jellyfish matrices. A study conducted by Nurjanah et al. (2013) on fresh Aurelia aurita samples recorded a high protein content of 35.63% on a dry basis (db), accompanied by a taurine content of 2.68% db. Similar findings were reported for the species Lychnorhiza malayensis, where Bragadeeswaran et al. (2024) documented a protein content of 24.28 g/100 g. In addition to macronutritional parameters, the study by Bragadeeswaran et al. (2024) also included toxicity assessments, which demonstrated that L. malayensis exhibited no hemolytic activity.

2. Identification of Bioactive Compounds and Utilization Potential

Beyond proximate profiles, several studies have identified the presence of specific functional compounds in jellyfish. In Bougainvillia sp., Muthmainnah

(2007) reported the presence of alkaloid compounds that exhibited bactericidal activity against Vibrio pathogenic bacteria in fish.

In another sector, Yusuf et al. (2020) highlighted the economic potential of red jellyfish (Crambione mastigophora) based on its collagen content. The study reported that this species is rich in collagen, ranging from 2.1 to 10.3 mg/g, suggesting its suitability as a raw material for cosmetic applications. Meanwhile, a nutritional review by Guttuso et al. (2025) on various jellyfish species within the class Scyphozoa indicated that these organisms have potential as aquaculture feed (aquafeed) ingredients, supported by their high levels of arachidonic acid (ARA) and amino acids that function as feeding attractants.

3. Effects of Processing Methodologies on Chemical Composition

Sample conditions and preparation methods have been reported to influence the final chemical parameters of jellyfish. Abdiani et al. (2022) compared fresh and dried samples of Rhizostoma pulmo and found that the drying process significantly increased ash content due to salt incorporation. Regarding dehydration methods, Kogovšek et al. (2014) reported that freeze-drying in Aurelia aurita and several other species was able to preserve nitrogen and carbon profiles in samples more effectively compared with conventional oven-drying methods.

4. Proximate Composition Based on Species and Sample Conditions

The results of the literature review regarding proximate composition data—including moisture, ash, protein, fat, and carbohydrate contents—from several jellyfish species under different sample conditions are presented in Table 3. The reported proximate values showed considerable variation depending on species differences (such as Aurelia aurita, Rhizostoma pulmo, Lychnorhiza malayensis, and Crambionella annandalei) and preparation methods (fresh, dried, and salt-dried conditions).

Table 3. Comparison of proximate analysis data (moisture, ash, protein, fat, and carbohydrate contents) of several jellyfish species from multiple references.

Reference Species /	Jellyfish Condition Type	Sample (%)	Moisture (%)	Ash (%)	Protein (%)	Fat (%)	Carbohydrate
(Nurjanah et al. 2013)	*Aurelia aurita*	Fresh	94,78	-	35,63	13,22	14,37
		Dried	-	36,59	35,40	0,96	-
(Abdiani et al. 2022)	*Rhizostoma pulmo*	Fresh	96,20*	1,00	34,50	12,50	47,90
		Dried	58,78*	11,00	46,30	1,50	39,90
(Bragadeeswaran et al. 2024)	*Lychnorhiza malayensis*	salt-dried	24,61	52,89	24,28	0,26	-
(Bragadeeswaran et al. 2024)	*Crambionella annandalei*	salt-dried	61,85	62,93	7,11	0,70	-
(Guttuso et al. 2025)	Scyphozoa	Variatif	91,1–98,0*	15,4–85,6	0,2–76,8	0,17–12,3	0,1–22,71

(Note: * Based on wet basis)

Based on the data presented in Table 2, fresh jellyfish samples exhibit extremely high moisture content. Fresh Aurelia aurita was reported to contain 94.78% moisture, while fresh Rhizostoma pulmo reached 96.20% (wet basis). In general, the Scyphozoa class exhibits moisture content variations ranging from 91.1% to 98.0% in fresh conditions. Conversely, the drying process resulted in a substantial reduction in moisture content, as observed in salt-dried Lychnorhiza malayensis (24.61%) and salt-dried Crambionella annandalei (61.85%). In contrast to moisture content, ash content showed a substantial increase in samples subjected to drying processes. In R. pulmo, ash content increased from 1.00% in fresh samples to 11.00% after drying. The highest increases in ash content were observed in salt-dried samples, where L. malayensis recorded an ash content of 52.89% and C. annandalei reached 62.93%. Overall, ash content variations within the Scyphozoa class have been reported to range from 15.4% to 85.6%.

Protein analysis data indicate that several jellyfish species maintain relatively stable protein percentages under both fresh and dried conditions. In A. aurita, protein content was recorded at 35.63% in fresh samples and 35.40% in dried samples. Meanwhile, dried R. pulmo exhibited the highest protein content among the specific species evaluated, reaching 46.30%, compared with 34.50% in fresh conditions. In salt-dried samples, L. malayensis showed a protein content of 24.28%, which was relatively higher than that of C. annandalei (7.11%). Overall, the Scyphozoa class demonstrates a wide variation in protein content, ranging from 0.2% to 76.8%.

Lipid content across all evaluated species tended to be relatively low, particularly in dried samples. In fresh samples, lipid contents of A. aurita and R. pulmo were reported as 13.22% and 12.50%, respectively. However, under dried and salt-dried conditions, lipid content decreased substantially to below 2% (e.g., 0.96% in dried A. aurita, 1.50% in dried R. pulmo, 0.26% in salt-dried L. malayensis, and 0.70% in salt-dried C. annandalei).

For carbohydrate content, the available data were more limited and only reported for certain sample conditions. R. pulmo showed carbohydrate contents of 47.90% in fresh samples and 39.90% in dried samples. Meanwhile, fresh A. aurita contained 14.37% carbohydrates. Several other dried samples, including dried A. aurita and both salt-dried species, did not report carbohydrate content in the reviewed literature.

Overall, the proximate composition dynamics described above demonstrate that post-harvest interventions, particularly drying methods, substantially alter the chemical matrix proportions of jellyfish. To provide a more comprehensive comparative overview of nutritional fluctuations caused by dehydration processes, the specific proximate composition percentages of processed samples (dried and salt-dried) are visualized in Figure 2. Fresh samples were excluded from this visualization to allow a more proportional observation of concentrated macronutrient components without being affected by the extreme dominance of moisture content under fresh conditions.

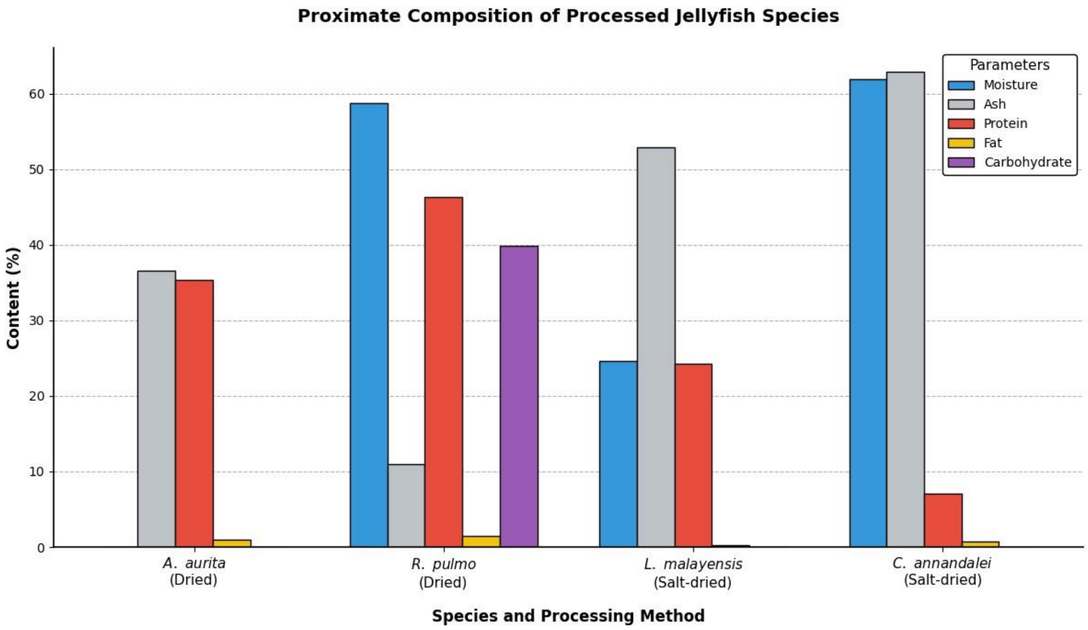

Figure 2. Comparison of proximate composition among various jellyfish species under processed conditions (dried and salt-dried).

As illustrated in Figure 2, the shifting patterns of macronutrient composition caused by dehydration methods can be observed more clearly. In salt-dried samples, such as L. malayensis and C. annandalei, ash content exhibited an extreme increase, exceeding all other parameters due to the accumulation of salt-derived mineral residues. In contrast, samples dried without excessive salt intervention, such as R. pulmo, demonstrated better protein retention, with protein becoming the most prominent macronutrient component. Furthermore, this visualization reinforces previous findings that fat content consistently remains at a marginal proportion across all dried processing methods.

In addition, three major nutritional components, namely protein, ash, and fat, were visualized (Figure 3) to evaluate whether their concentrations increased or decreased after jellyfish dehydration.

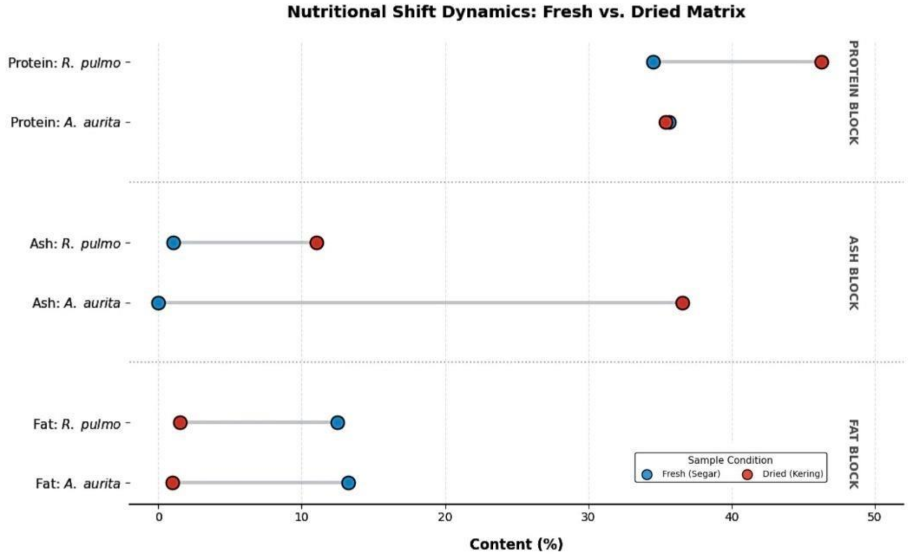

Figure 3. Segmented dumbbell plot illustrating shifts in macronutrient composition (protein, ash, and fat) between fresh and dried conditions in Aurelia aurita and Rhizostoma pulmo.

As shown in the protein section of Figure 3, both jellyfish species exhibited different responses after drying. Protein content in Aurelia aurita remained highly stable, as indicated by the nearly overlapping positions of fresh and dried samples, with values of 35.63% and 35.40%, respectively. In contrast, Rhizostoma pulmo experienced a substantial increase in protein content due to moisture loss, increasing from 34.50% in fresh samples to 46.30% after drying. Meanwhile, the ash parameter demonstrated that both jellyfish species experienced an increase in ash content after drying, indicated by the extended connecting lines toward higher values. The highest increase was observed in Aurelia aurita, where ash content increased from undetectable levels in fresh samples to 36.59% after drying. Similarly, Rhizostoma pulmo also showed an increase in ash content, although the change was less pronounced, increasing from 1.00% to 11.00%. Unlike protein and ash, fat content consistently decreased after drying, as indicated by the movement of the connecting lines toward lower values. In fresh conditions, both Aurelia aurita and Rhizostoma pulmo contained relatively higher fat levels, at 13.22% and 12.50%, respectively. However, after drying, fat content in both species decreased substantially to below 2%, reaching only 0.96% in Aurelia aurita and 1.50% in Rhizostoma pulmo.

DISCUSSION

1. Evaluation of Basic Nutritional Composition and Species Characteristics

The high protein content reported in various jellyfish species, such as Aurelia aurita (35.63% db) and Lychnorhiza malayensis (24.28 g/100 g), confirms that these gelatinous organisms are not merely water-dominated biomass but also represent a potential source of organic nitrogen (Paungfoo-Lonhienne et al., 2008; Santosa et al., 2021). Biologically, jellyfish proteins primarily constitute the mesoglea structure in the form of strong yet elastic collagen and fibrillin fibers (Hausman & Burnett, 1969; Megill et al., 2005). The presence of taurine at 2.68% db in A. aurita provides significant additional nutritional value. Taurine is a free sulfonic amino acid that plays essential roles in cellular osmoregulation, bile acid conjugation, and endogenous antioxidant mechanisms.

From a food safety and biomedical perspective, the findings of Bragadeeswaran et al. (2024), which demonstrated that L. malayensis exhibited no hemolytic activity, represent an important advancement. The absence of hemolytic toxicity provides preliminary evidence regarding the safety potential of jellyfish-derived products for human consumption or topical applications, without inducing adverse hemolytic or cytotoxic effects.

2. Industrial Downstream Potential and the Impact of Processing Methodologies on Chemical Stability

The utilization of jellyfish has shifted toward high-value biotechnology industries due to their functional bioactive compounds. Alkaloid compounds found in Bougainvillia sp. show potential as natural antibacterial agents for controlling vibriosis in aquaculture, while collagen from Crambione mastigophora (2.1–10.3 mg/g) demonstrates promising applications in premium cosmetic products due to its high water-binding capacity and lower risk of mammalian zoonotic disease transmission. Furthermore, the high levels of arachidonic acid (ARA) and feeding attractants found in the Scyphozoa class position jellyfish as a potential substitute for fishmeal to support immune responses and feeding stimulation in fish larvae.

However, successful industrial valorization strongly depends on dehydration methods, as jellyfish tissues are highly sensitive to heat and salt exposure. Salt-drying of Rhizostoma pulmo has been shown to substantially increase ash content due to the penetration and crystallization of exogenous ions within the mesoglea tissue during osmotic processing. Meanwhile, to preserve organic components such as proteins in Aurelia aurita, freeze-drying demonstrates superior performance compared with conventional oven-drying methods (Czuryńska & Lenart, 2011; Aulia et al., 2023). Through lowtemperature sublimation, freeze-drying minimizes tissue shrinkage and thermal denaturation of nitrogen-containing compounds. Conversely, excessive heat exposure during oven-drying may disrupt protein hydrogen bonds and promote Maillard reactions, leading to reduced nitrogen quality in the final jellyfish product.

3. Moisture Dynamics and Transformation of the Proximate Solid Matrix

The extremely high moisture content of fresh jellyfish, ranging from 91.1% to 98.0% in the Scyphozoa class (Guttuso et al., 2025), including A. aurita (94.78%) and R. pulmo (96.20%), reflects the anatomical structure of jellyfish, which is dominated by a cellular mesoglea matrix. This mesoglea functions as a biological hydrogel capable of retaining large amounts of water through loosely arranged collagen fiber networks.

During dehydration, the removal of free water and part of the bound water triggers substantial tissue volume reduction, causing the remaining organic and inorganic solid components to become more concentrated. The methodological approach applied in Figure 2, which excludes fresh samples, is highly important for proximate analysis interpretation of gelatinous marine organisms. The dominance of moisture content approaching 96% in fresh conditions may introduce visual scaling distortion and obscure the actual proportions of other macronutrients. By isolating processed samples only (dried and salt-dried conditions), the fluctuations and dominance of solid components after dehydration can be evaluated more objectively and proportionally.

4. Analysis of Changes in Ash, Protein, and Fat Content After Drying

Based on the graphs presented in Figures 2 and 3, all jellyfish samples exhibited increased ash content after drying. In conventional drying without salt addition, the increase in ash content observed in R. pulmo (from 1.00% to 11.00%) and A. aurita (36.59%) primarily resulted from natural concentration effects. As water evaporates, naturally occurring marine minerals within jellyfish tissues remain and become more concentrated.

A much greater increase in ash content was observed in salt-dried jellyfish samples, such as L. malayensis (52.89%) and C. annandalei (62.93%). This phenomenon is attributed to the incorporation of sodium chloride (NaCl) crystals into jellyfish tissues during salting. Salt draws out water from jellyfish tissues and subsequently accumulates within the matrix, causing mineral residues to dominate a substantial proportion of the dried biomass.

Regarding protein content, jellyfish species exhibited different responses depending on their biological characteristics. Protein content in Aurelia aurita remained highly stable before and after drying (35.63% to 35.40%). This indicates that structural proteins, particularly collagen, in A. aurita possess relatively high stability and are not easily degraded during drying processes. In contrast, the considerable increase in protein content observed in Rhizostoma pulmo (from 34.50% to 46.30%) does not indicate an actual increase in protein quantity, but rather a concentration effect caused by the reduction of other components, such as carbohydrates, which decreased from 47.90% to 39.90%. The degradation or loss of carbohydrates and lipids consequently increased the relative proportion of protein when calculated on a dry weight basis. Meanwhile, the low protein content of salt-dried C. annandalei (7.11%) was associated with its extremely high ash content (62.93%), which reduced the relative proportion of other nutritional components.

Unlike ash and protein, fat content consistently decreased substantially to below 2% after drying across all jellyfish species. Although fresh A. aurita (13.22%) and R. pulmo (12.50%) showed relatively higher lipid levels, drying resulted in significant lipid reduction. This consistent decline may occur through two mechanisms. First, the thin cellular structure of jellyfish tissues may rupture during salt exposure or thermal drying, causing lipid compounds to be released and removed together with expelled water. Second, jellyfish lipids contain high proportions of polyunsaturated fatty acids (PUFAs), which are highly susceptible to oxidation. During drying, exposure to oxygen and elevated temperatures may accelerate lipid oxidation, resulting in degradation of fatty acids and reduced lipid levels in the final dried jellyfish products.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the systematic literature review, jellyfish possess significant potential as an alternative marine resource with high economic value. The synthesis of seven studies indicates that jellyfish contain important nutritional components, including proteins, collagen, amino acids, taurine, and various bioactive compounds with potential applications across multiple industrial sectors. The proximate characteristics of jellyfish are strongly influenced by species variation, sample conditions, and processing methods. The extremely high water content of fresh jellyfish represents a major challenge for storage; however, drying processes can improve stability and increase the concentration of nutritional components. Nevertheless, certain drying methods, such as salting, may increase ash content due to the incorporation of salt-derived minerals. Overall, jellyfish should not only be regarded as marine organisms that disrupt ecosystems but also as a sustainable biomass resource with substantial potential for the development of food products, cosmetics, biotechnology, and aquaculture applications.

Further research is required to develop processing methods capable of optimally preserving the nutritional quality of jellyfish. In addition, more comprehensive studies are needed regarding food safety, bioactive compound characterization, nutrient bioavailability, and the development of jellyfish-based products for industrial applications.

ADVANCED RESEARCH

Every study has limitations, including this literature review. The primary limitation of this study is the limited availability of relevant literature and the considerable variability among studies in terms of jellyfish species, sampling locations, preparation methods, and laboratory analysis procedures. Most previous studies have focused primarily on basic proximate composition analysis, while information regarding molecular characterization, biological activity, consumption safety, and bioactivity mechanisms remains limited. Future research is recommended to employ more advanced analytical approaches, such as proteomics, metabolomics, and bioactive compound characterization. Furthermore, studies focusing on processing technology optimization, food product formulation, and industrial feasibility evaluation are required to support the commercial and sustainable utilization of jellyfish resources.

REFERENCES

Abdiani, I. M., Kirana, E., Yulianto, A., Akhmadi, M. F., Simanjuntak, R. F., & Imra. (2022). Proximate analysis of fresh and dried jellyfish (*Rhizostoma pulmo*). *Jurnal Harpodon Borneo*, 15(1), 50–59.

Aswar, Hamarung, M. A., Jasman, Sirama, Yantony, D., & Asmauna, A. (2026). Innovation of fish drying technology in Indonesia for quality enhancement of dried fish products: A literature review. *Jurnal Penelitian Inovatif (JUPIN)*, *6*(1), 265–276. https://doi.org/10.54082/jupin.1983

Arham, B., & Dimyati, M. (2024). Systematic literature review (SLR): Explorations flood systems theory and appropriate modeling. *Journal of Smart Agriculture and Environmental Technology*, *2*(2), 67–80. https://doi.org/10.60105/jsaet.2024.2.2.67-80

Aulia, D., Putra, A., Aini, S., Hertanto, D., Yuliandri, R., Sabariyah, N., & Hadiwinata, B. (2023). *Comparison of the effectiveness of fish product drying: A study between semi-automatic drying equipment and conventional methods*. Jurnal Perikanan, 13(4), 1056–1064. https://doi.org/10.29303/jp.v13i3.670

Baumberg, J. J. (2018). Publish or perish. In *The secret life of science*. Princeton University Press. https://doi.org/10.23943/9781400889303-005

Czuryńska, A., & Lenart, A. (2011). *Freeze-drying – Application in food processing and biotechnology – A review*. Polish Journal of Food and Nutrition Sciences, 61(3), 165–171. https://doi.org/10.2478/v10222-011-0017-5 .

Hausman, R. E., & Burnett, A. L. (1969). *The mesoglea of Hydra. I. Physical and histochemical properties*. Journal of Experimental Zoology, 171(1), 7–13. https://doi.org/10.1002/jez.1401710103.

Jabbar, F. A., Setiawati, A., Laela, M. N., Pramono, T. B., & Abida, I. W. (2023). Adaptive strategy on sustainable management of aquatic resources amidst climate change. Jurnal MAIYAH. https://doi.org/10.20884/1.maiyah.2023.2.4.10665

Moher, D., Liberati, A., Tetzlaff, J., Altman, D. G., & PRISMA Group. (2009).

Megill, W. M., Gosline, J. M., & Blake, R. W. (2005). The modulus of elasticity of fibrillin-containing elastic fibres in the mesoglea of the hydromedusa Polyorchis penicillatus. The Journal of Experimental Biology, 208(19), 3819– 3832. https://doi.org/10.1242/jeb.01765.

Muthmainnah, N. (2007). *The effectiveness of jellyfish (Bougainvillia sp.) alkaloids administered through feed on the total of Vibrio spp. bacteria in tiger grouper (Epinephelus fuscoguttatus)* [Undergraduate thesis, Universitas Brawijaya].

Nurjanah, Jacoeb, A. M., Nurokhmatunnisa, & Pujianti, D. (2013). Amino acid, taurine, macro-micro mineral, and vitamin B12 content of fresh and dried jellyfish (*Aurelia aurita*). *Jurnal Pengolahan Hasil Perikanan Indonesia*, 16(2), 95– 107.

Pati, D., & Lorusso, L. N. (2018). How to write a systematic review of the literature. *HERD: Health Environments Research & Design Journal*, *11*(1). https://doi.org/10.1177/1937586717747384

Preferred reporting items for systematic reviews and meta analyses: ThePRISMA statement. BMJ, 339, b2535. https://doi.org/10.1136/bmj.b2535 Assar, S., Jalalpour, S., Ayoubi, F., Rahmani, M. R., & Rezaeian, M. (2016). PRISMA: Preferred reporting items for systematic reviews and metaanalyses. Journal of Rafsanjan University of Medical Sciences, 15(1), 63–80.

Paungfoo-Lonhienne, C., Lonhienne, T. G. A., Rentsch, D., Robinson, N., Christie, M., Webb, R. I., Gamage, H. K., Carroll, B. J., Schenk, P. M., & Schmidt, S. (2008). *Plants can use protein as a nitrogen source without assistance from other organisms*. Proceedings of the National Academy of Sciences of the United States of America, 105(11), 4524–4529. https://doi.org/10.1073/pnas.0712078105

Rahmah, F. F., & Zakaria, I. J. (2017). Abundance of jellyfish (*Aurelia aurita* L.) in coastal waters of Batu Kalang Tarusan, Pesisir Selatan Regency, West Sumatra. *Dinamika Lingkungan Indonesia*, *4*(1), 1–7.

Racero-Galaraga, D., Rhenals-Julio, J. D., Sofan-German, S., Mendoza, J. M., & Bula-Silvera, A. (2024). Proximate analysis in biomass: Standards, applications and key characteristics. Results in Chemistry, 12, 101886. https://doi.org/10.1016/j.rechem.2024.101886

Yusuf, S., Ramli, Yusuf, S., & Apriadi, J. (2020). Utilization of red jellyfish (*Crambione mastigophora*): Stinger pest becomes an export commodity of Saleh Bay, Sumbawa Island. *Prosiding Seminar Nasional IPPeMas 2020: Inovasi Hasil Penelitian dan Pengabdian kepada Masyarakat dalam Menunjang Era Industri 4.0*, 215–223.