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Overcoming Malnutrition in the Elderly through Local Resources: The Potential of Protein and Calcium in Wader Fish (*Rasbora argyrotaenia*) for Food Security

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ABSTRACT

Malnutrition among Indonesian elderly, particularly protein and calcium deficiency, has reached an alarming level, especially in nursing homes. Dependence on expensive commercial supplements exacerbates nutritional inequality. This narrative review synthesizes existing literature to explore the potential of wader fish (*Rasbora argyrotaenia*), an overlooked local resource, as a sustainable solution. Whole wader fish possess an excellent nutritional profile with high protein (17.0 g/100 g) and calcium content (500 mg/100 g), and can be consumed with bones to maximize mineral absorption. Economically, this fish is highly affordable and widely distributed across Java, Sumatra, and Kalimantan, with substantial national production. Traditional processing methods such as *pepes* (spiced steamed fish in banana leaves) or steaming are recommended to create elderly-friendly products with soft textures and preserved nutritional value. Integrating Wader fish into elderly nutrition programs offers an effective, economical, and culturally rooted approach while supporting food security, local community empowerment, and reducing import dependency. Sustainable implementation through responsible fishing and aquaculture is essential to ensure long-term availability.

Keyword: Wader fish, *Rasbora argyrotaenia*, malnutrition.

Introduction

The aging population in Indonesia has raised serious issues related to elderly malnutrition, which affects health and quality of life, as it directly impacts the healthcare system, economic stability, and social welfare in Indonesia (BPS, 2024). In 2024, Indonesia experienced rapid population aging, with the number of elderly individuals aged 60–80 continuing to increase. This demographic shift brings significant challenges, particularly malnutrition among the elderly population, which threatens their health and quality of life.

Malnutrition among the elderly in Indonesia has reached an alarming level and requires immediate action. Research by Dewiasty et al. (2024) revealed that in urban areas, especially on the islands of Java and Bali with most data collected from Jakarta, Bandung, and Denpasar about 66% of elderly people in nursing homes suffer from protein deficiency, while more than 90% experience calcium deficiency. The prevalence of malnutrition ranges from 6.5% to 48.3% in hospitals and 3.2% to 61.0% in nursing homes. These figures indicate a significant nutritional intake gap that endangers elderly health. The consequences are severe, as protein deficiency leads to muscle mass loss (sarcopenia), increased risk of falls, and reduced physical function (Bauer et al., 2013). Calcium deficiency causes osteoporosis and bone fractures, which can be fatal for older adults.

Current solutions to combat malnutrition rely heavily on commercial supplements and imported fortified products. However, these products are often too expensive for most people, especially those living in rural areas and low-income groups (Yasyifa et al., 2025). This

situation creates nutritional inequality, where only financially capable elderly individuals can access proper nutrition, while vulnerable populations remain at risk. Moreover, dependence on costly imported products weakens food independence and overlooks Indonesia's rich aquatic resources.

Indonesia's freshwater ecosystems offer untapped opportunities to address nutritional problems through local and culturally appropriate solutions. Among various fish species, wader fish shows great potential as a source of protein and calcium for the elderly. This small native fish, measuring 5–10 centimeters, is typically harvested within 3–5 months. It is commonly found in East Java, particularly in Mojokerto City, such as the Trowulan area. Wader fish can be consumed whole, including bones and organs. For elderly consumption, steaming is recommended as it is healthier and suitable for those with bone-related conditions (osteoporosis). Studies indicate that whole wader fish consumption can be an excellent source of calcium and protein (Azzahra et al., 2024). Wader fish also contains high levels of iron and zinc at a lower cost compared to larger fish such as milkfish (*Chanos chanos*) (Susilowati, 2010). A report from Japan involving over 80,000 participants found that consuming small fish whole reduces mortality risk (ScienceDaily, 2024).

Despite these benefits and cultural acceptance, wader fish remains underutilized in formal nutrition programs for elderly care. Its current use is limited to traditional consumption without integration into systematic health strategies. This represents a missed opportunity to harness local resources while supporting fishing communities and promoting a sustainable food system.

Malnutrition among the elderly in Indonesia has been well documented, and wader fish is traditionally recognized as a local food source. However, several research gaps still exist;

1. Lack of specific nutritional data on wader fish for the elderly. There is no comprehensive study analyzing the protein and calcium content of wader fish specifically in relation to the nutritional needs of elderly individuals in Indonesia.
2. Limited development of elderly friendly processed products. Wader fish is generally consumed traditionally by frying, without the development of processed forms adapted to the physical condition of the elderly (such as soft texture, easy digestibility, and safety for individuals with osteoporosis). There is also no systematic implementation strategy, as no model or guideline currently exists for integrating wader fish into elderly nutrition programs in healthcare facilities, nursing homes, or home-care services.
3. Lack of studies on accessibility and affordability. No analysis has been conducted regarding the availability, price, and accessibility of wader fish compared to commercial supplements or imported fortified products for low-income elderly populations in Indonesia.

This review proposes the comprehensive utilization of wader fish as an affordable and locally sourced provider of protein and calcium for the elderly population. The proposed solution includes a nutritional content analysis to establish scientific data, the development of elderly-friendly products that meet specific dietary needs, the creation of an integration plan through existing healthcare facilities, and the establishment of a community-based production system.

Target audience includes the government in policy regulation, healthcare practitioners, managers of elderly care facilities such as nursing homes or hospitals, researchers and academics, as well as fishing communities and local business actors. The significance of this review lies in its contribution to providing scientific data on the nutritional potential of wader fish as an affordable solution to address elderly malnutrition in fulfilling protein and calcium

needs in Indonesia. It offers a local resource based alternative, opens economic opportunities for local fishers, and supports food security policies and national nutritional independence in Indonesia. Furthermore, it provides a foundation for developing elderly-friendly processed products and sustainable implementation strategies, thereby contributing to improving the health and quality of life of the elderly while preserving local wisdom in the utilization of Indonesia's aquatic resources.

Methods

Review Approach

This method employs a narrative review approach to categorize scientific literature related to *Rasbora argyrotaenia* as an alternative source of protein and calcium for the elderly in Indonesia. The narrative review emphasizes the integration of information from various sources to compile a discussion on the protein and calcium values found in wader fish that can help address malnutrition among the elderly(Ferrari, 2015). This review consists of an abstract, background, research method, discussion and analysis, as well as a conclusion.

Scope of this review focuses on the protein and calcium content of wader fish. This review does not involve laboratory testing or direct product processing but instead emphasizes literature studies used to answer the research questions and objectives of this article.

Literature Search Strategy

Literature search strategy in this review utilized databases such as Google Scholar, Scopus, and data from Indonesian government ministries (the Ministry of Health and the Ministry of Agriculture). Languages used in the literature search were English and Indonesian. In Indonesian, the keywords used were "ikan wader," "protein ikan wader," "kalsium," and "malnutrisi pada lansia". In English, the keywords used were "Wader fish *Rasbora argyrotaenia*," "malnutrition," "protein," and "calcium".

Boolean operator "AND" was applied to refine the search results, as in "Protein wader fish AND Calcium wader fish". Publication period selected ranged from 2010 to 2025. This range was chosen to ensure the inclusion of recent studies and to identify updates and developments in relevant research.

Inclusion and Exclusion Criteria for Scientific Journals on Protein and Calcium Content in Wader Fish (Rasbora argyrotaenia)

Inclusion and exclusion criteria were applied to ensure that the selected scientific journals or articles were relevant to the topic discussed. The article search was limited to publications from 2010 to 2025. The included articles were those that discussed the nutritional aspects of wader fish, specifically protein and calcium. Articles that did not address these topics were excluded from the literature review process.

Table 1. *Inclusion and exclusion criteria for scientific journals on the protein and calcium content of wader fish (Rasbora argyrotaenia).*

Inclusion	Exclusion
Articles, scientific journals, and government publications that discuss protein and calcium content in the elderly.	Articles that discuss fish other than wader fish (*Rasbora argyrotaenia*) or fish that are not relevant to the topic of this study.

Studies that discuss the issue of malnutrition among the elderly, particularly those related to protein and calcium deficiencies.	Articles and scientific journals with unclear sources, such as personal opinions from blogs or non-academic websites.
Articles and scientific journals published within the period of 2010–2025.	Articles and scientific journals that are not fully accessible or do not provide detailed discussions.

Selection Process and Study

Literature selection was conducted using a systematic approach to ensure that the chosen articles were truly relevant to the topic. The selection process began by establishing the research idea or theme, namely regarding the protein and calcium content in wader fish and its relationship with bone health in elderly individuals. Subsequently, the research objectives were elaborated to guide the literature search in a more focused manner. The next stage involved collecting references through literature study searches from various scientific databases. The collected literature was then selected according to topic relevance, followed by grouping the literature results based on discussion focus, namely protein content and calcium content. The final stage of this process was the arrangement of the discussion, ultimately leading to the conclusion. The sequence of literature selection and study stages is presented concisely in the diagram shown in Figure 1.

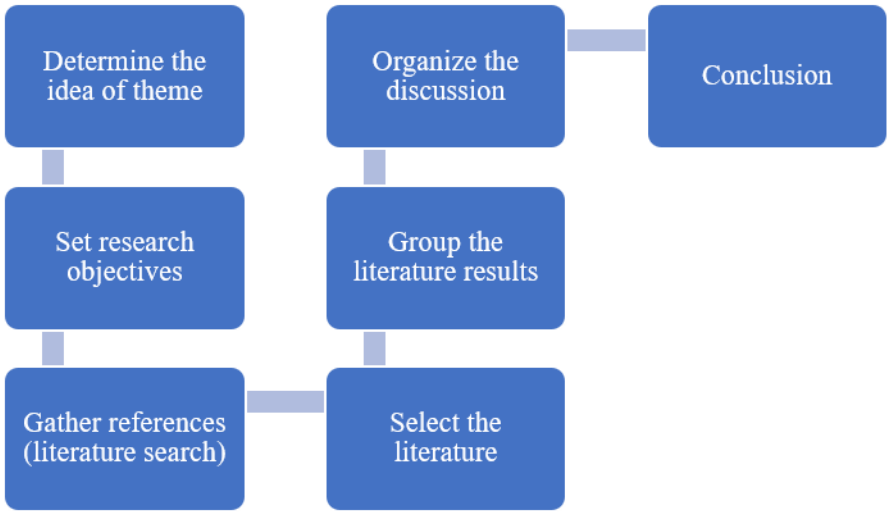

Figure 1. Selection process and literature review of scientific journals on the protein and calcium content of wader fish (*Rasbora argyrotaenia*).

The literature selection process in this study was conducted in stages to ensure the quality and relevance of the articles used. The first stage involved selection based on titles and abstracts, in which only literature discussing protein and calcium in wader fish was included. Subsequently, in the second stage, the relevance of the topic was assessed by examining whether the protein and calcium content of wader fish was related to the issue of malnutrition among the elderly. Literature that passed both stages was then used as the main reference in the writing of the study (Figure 2).

After the literature was successfully selected, the next step was categorization based on similarities in research focus. This grouping was carried out to facilitate analysis, for example

by separating literature that discussed protein content in wader fish from literature that focused on calcium content in wader fish. By categorizing the literature according to similar themes, the relationship between protein and calcium in wader fish in relation to osteoporosis management could be identified more clearly, thereby making the discussion more structured and easier to understand.

Next, during the discussion development stage, in-depth analysis was conducted for each group of literature that had been established. Various findings from the literature were compared and interconnected to obtain a comprehensive understanding. This analytical process aimed to reveal the benefits and potential of wader fish, particularly the roles of calcium and protein, in addressing the problem of osteoporosis.

The final stage of the entire process was the formulation of conclusions. The conclusions were composed comprehensively as a summary that addressed the research objectives. They emphasized that wader fish contain protein and calcium with the potential to serve as an alternative nutritional source to help address osteoporosis. The sequence of analysis, from categorization to discussion, ultimately converged on the core message supporting the contribution of the research findings.

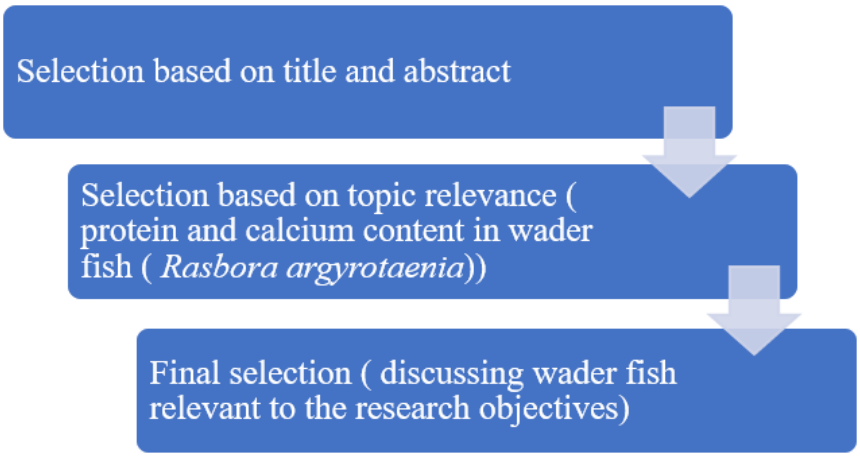

Figure 2. Data selection stage for scientific journals on the protein and calcium content of wader fish (*Rasbora argyrotaenia*).

Analysis and Synthesis Techniques

Selected literature data were then analyzed and synthesized to extract information relevant to the topic. The included literature focused on the nutritional content of wader fish, particularly its protein and calcium composition. In addition, data were obtained from various databases, including scientific journals discussing malnutrition issues in Indonesia.

Results and Discussions

Malnutrition Issues Among the Elderly in Indonesia

Malnutrition problem is related to calcium, which is a very important mineral and has a significant impact, particularly in the context of micronutrient deficiency. In reality, calcium intake at the individual, community, and societal levels in Indonesia tends to be low, which triggers the occurrence of various calcium-deficiency-related diseases, such as osteoporosis in the elderly. Limited availability and intake of calcium have become a serious health problem

(Santosa & Noviandi, 2024). The table of malnutrition prevalence among the elderly in Indonesia is presented in Table 2.

Table 2. Prevalence of malnutrition among Indonesian seniors

Location	Prevalence of Malnutrition (%)	Source
Urban communities	44	
Rural communities	18–57	
Polyclinics	2–14	Dewiasty et al. (2024)
Hospital inpatient care	6–48	
Nursing Homes	3–61	

Based on a systematic review byDewiasty et al., (2024), malnutrition among elderly individuals in Indonesia across various healthcare settings shows significant variation. The nutritional intake of Indonesian older adults, particularly in terms of protein and calcium, is in a concerning condition, with a very high rate of inadequacy, especially in nursing homes. These findings highlight the severity of malnutrition and the urgent need for more comprehensive nutritional interventions as well as health policies focused on the elderly population in Indonesian care facilities.

Malnutrition among the elderly is not only caused by limited food intake but also by the decline in physiological functions associated with aging. Older adults experience reduced appetite, decreased chewing ability, and lower efficiency of nutrient absorption, thereby requiring food sources that are nutrient-dense, easily digestible, and economically affordable. Protein deficiency accelerates the development of sarcopenia, leading to reduced mobility and independence, while calcium deficiency increases the risk of osteoporosis and fractures, which may result in disability or even death. Therefore, nutritional interventions for the elderly should focus on providing adequate sources of protein and calcium in sufficient quantities and in forms that are appropriate to the biological conditions of older adults.

Nutritional Profile and Processing Recommendations for Wader Fish

Wader fish is a native Indonesian freshwater species with excellent nutritional properties, yet it has not been fully utilized. Every 100 grams of fresh wader fish contains a high protein content of 17.0 grams and calcium of 500.0 mg (Palupi et al., 2025). Wader fish is known for its tender meat despite having many small bones, which can become softer when processed using high-pressure cooking methods (Palupi et al., 2025). In addition to its abundant protein and calcium content, consuming wader fish provides a complete nutritional source to address micronutrient deficiencies.

Its protein content contributes significantly to meeting daily protein requirements to prevent sarcopenia. The main advantage of wader fish lies in its mode of consumption, which allows it to be eaten whole, including the bones, thereby increasing the bioavailability of natural calcium without the need for artificial fortification processes. This characteristic makes wader fish a relevant functional food source for the elderly, particularly for low-income groups with limited access to commercial supplements.

Processing methods such as steaming, pepes (steaming in banana leaves), and high-pressure cooking are highly suitable for the elderly because they soften the texture of the bones and fish tissues without reducing protein and mineral content. The soft texture reduces the risk of choking and facilitates digestion, especially for elderly individuals with dental problems or dysphagia. In addition, these methods do not require excessive fat addition as in frying, making them safer for the elderly with degenerative diseases such as hypertension and cardiovascular disorders.

Availability and Sustainability of Wader Fish

Wader fish are distributed across almost all rivers and reservoirs in Java, Sumatra, and Kalimantan. Statistics from the Directorate General of Capture Fisheries (2022) recorded a national production of 3,842 tons per year, with 70% coming from Central and East Java. Price at traditional markets in Pacitan Regency as of October 2025 ranges from Rp 15,000 to 20,000 per kilogram, remaining affordable for low-income elderly individuals. Wader fish can be processed for elderly consumption using traditional Indonesian methods. Sustainability of wader fish can be maintained by avoiding overfishing and using the pepes method, which involves wrapping the fish in banana leaves before cooking. Wader fish processed into pepes offers advantages in preserving selective nutritional value while conserving its habitat by avoiding river pollution. These efforts are key to ensuring that wader fish populations remain sustainable for future generations.

Wader fish play an important role in supporting food security because they are widely available in inland waters, relatively inexpensive, and rich in protein and calcium. Their management can also be carried out sustainably by local communities. By incorporating wader fish into nutrition programs for the elderly, we can help improve their nutritional intake while also strengthening local food systems and decreasing dependence on imported fortified products.

Conclusion

Rasbora argyrotaenia has significant nutritional potential in addressing malnutrition among the elderly in Indonesia. Every 100 grams of wader fish contains relatively high protein at 17.0 grams and calcium at 500 mg, thus helping to meet daily calcium needs and providing high-quality protein to maintain body functions. Processing wader fish for elderly consumption can use high-pressure cooking methods, which give a softer and more easily digestible texture while still retaining the natural taste and comprehensive nutritional value. Economically, wader fish is considered affordable, with prices ranging from Rp15,000 to Rp20,000 in traditional markets such as in Pacitan, allowing low-income elderly people to meet their protein and calcium needs without high costs.

Wader fish can be found in rivers and reservoirs throughout Java, Sumatra, and Kalimantan, and their sustainability can be maintained by preventing overfishing and applying environmentally friendly cooking methods such as high-pressure steaming with banana leaves ("*pepes*"), which preserves nutritional value while supporting environmental conservation. Nutritional content analysis faces several limitations, including a lack of local data, possible species differences used as references, and variations influenced by habitat. Additionally, the absence of direct experimental tests and surveys leads to uncertainty about the precise nutritional composition and limits the verification of malnutrition issues in the targeted elderly population

Methodological Limitations

This study has several limitations related to the analysis of the nutritional content of shallow water fish, particularly the limitation of local data availability, which restricts the accurate identification of species' nutritional content and indicates that the referenced data may represent different species. Additionally, the nutritional variability influenced by species and habitat reduces the ability to generalize existing findings, while the absence of direct experimental testing on actual samples limits the accuracy of the reported nutritional values, compounded by the lack of field surveys to verify malnutrition conditions in the targeted elderly groups. Therefore, future research is recommended to generate a comprehensive local dataset, conduct

species-specific analyses, perform controlled experimental testing, carry out field-based surveys to validate nutritional needs, and assess the effectiveness of shallow water fish as a dietary intervention.

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Conflict of Interest
No conflict of interest.

References

Bauer, J., Biolo, G., Cederholm, T., Cesari, M., Cruz-Jentoft, A. J., Morley, J. E., Phillips, S., Sieber, C., Stehle, P., Teta, D., Visvanathan, R., Volpi, E., & Boirie, Y. (2013). Evidence-based recommendations for optimal dietary protein intake in older people: A position paper from the prot-age study group. *Journal of the American Medical Directors Association*, *14*(8), 542–559. https://doi.org/10.1016/j.jamda.2013.05.021

BPS-Statistics Indonesia. (2024). *Statistics of aging population 2024*. https://www.bps.go.id/en/publication/2024/12/31/a00d4477490caaf0716b711d/statistics-of-aging-population-2024.html

Dewiasty, E., Setiati, S., Agustina, R., Saldi, S. R. F., Wisuda, N. Z., Pramudita, A., Kumaheri, M., Fensynthia, G., Rahmah, F., Jonlean, R., & De Groot, L. C. P. G. M. (2024). Malnutrition Prevalence and Nutrient Intakes of Indonesian Older Adults in Institutionalized Care Setting: A Systematic Review of Observational Studies. In *Annals of Nutrition and Metabolism* (Vol. 80, Number 5, pp. 235–252). S. Karger AG. https://doi.org/10.1159/000538790

Ferrari, R. (2015). Writing narrative style literature reviews. *Medical Writing*, *24*(4), 230–235. https://doi.org/10.1179/2047480615z.000000000329

Palupi, E., Oktaviani, R. I., Purnaningsih, N., Saraswati, Y., Putri, W. E., & Iwansyah, A. C. (2025). Development of wader-fish (Rasbora argyrotaenia) and kidney beans as a supplementary food: A source of protein and minerals for toddlers aged 12-24 months. *BIO Web of Conferences*, *153*. https://doi.org/10.1051/bioconf/202515303012

Santosa, W. N. (2024). EFFECT OF CALCIUM FORTIFICATION ON HEALTH. *Jurnal Wiyata: Penelitian Sains Dan Kesehatan*, *11*(1), 13. https://doi.org/10.56710/wiyata.v11i1.624

ScienceDaily. (2024). *Eating small fish whole can prolong life expectancy, Japanese study finds*. https://www.sciencedaily.com/releases/2024/06/240613140810.htm

Susilowati. (2010). *Perbedaan Hasil Abon Yang Terbuat Dari Ikan Gabus Dan Abon Ikan Bandeng Ditinjau Dari Biaya Produksi Dan Daya Beli Konsumen* (Number 11). www.google.com

Yasyifa, A., Suriadi, B., Oktaviana, T., Robbani, T., & Afifah, D. (2025). Perbandingan Kebijakan Proteksionisme Antara Indonesia - China dalam Upaya Mengurangi Ketergantungan Impor Melalui Peningkatan Kapasitas Produksi dalam Negeri. *Jurnal ISO: Jurnal Ilmu Sosial, Politik Dan Humaniora*, *5*(1), 15. https://doi.org/10.53697/iso.v5i1.2722