Journal of Management and Administration Provision
Vol. 4, Issue 3, 2024
Page 415-420
DOI: https://doi.org/10.55885/jmap.v4i3.692

The Potential of Microgreens in Indonesian Traditional Food Innovation: Opportunities, Challenges, and Culinary Innovation Based on Literature Studies

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Abstract. *Microgreens are young plants that are harvested in the early stages of growth, generally still in the form of sprouts that are 7-21 days old. In addition to containing high and adequate nutrients, microgreens also contain biotic compounds that are able to increase the body's metabolism. In recent years, the use of microgreens in the culinary world has continued to increase, including in Asia and Indonesia. This study aims to examine the use of microgreens as an additive to Indonesian typical foods by reviewing national and international scientific literature during the period 2020–2025. The method used was a documentation study with a thematic analysis approach to 20 relevant journals. The results of the study show that microgreens have the potential to be an innovative ingredient in the presentation of traditional and modern foods in Indonesia, especially in an effort to improve nutrition, aesthetic value, and market acceptance of healthy foods. A number of challenges such as short shelf life, production costs, and understanding the benefits of microgreens still need to be addressed. The study recommends the integration of microgreens in locally-based culinary innovations as a strategic opportunity in the development of healthy and sustainable food.*

Keywords: *Microgreens, Food, Culinary Innovation, Healthy Food*

Received: October 25, 2024 Received in Revised: November 19, 2024 Accepted: December 27, 2024

INTRODUCTION

The trend of consuming healthy foods has recently become a phenomenon among modern society, along with the increasing awareness of functional foods. The need for food sources that are easy to cultivate in limited space is one solution to finding fresh food sources with minimal use of chemicals. Therefore, amidst global challenges and issues of food sustainability, innovation in the development of healthy foods has emerged. Indonesia is known as a country with extraordinary culinary richness, cultural diversity, local ingredients, and traditional cooking techniques. Microgreens are one approach that is beginning to be developed in traditional Indonesian cuisine.

Microgreens are a food option worthy of being used as a healthy food ingredient (Bhaswant et al., 2023). Microgreens are small vegetables or young plants with a soft texture, harvested in the early stages of growth, between days 7 and 14, possessing high nutritional content and aesthetic appeal. International studies have shown that microgreens contain higher levels of minerals, vitamins, and biotic compounds than mature plants. Several studies in Indonesia have explored microgreens of mung beans, broccoli, red spinach, and kale as additional

E-ISSN: 2776-1290, P-ISSN: 2776-1282

ingredients in traditional dishes such as pecel (vegetable salad), gado-gado (Indonesian salad), and several other dishes. As a functional food, microgreens provide attractive color, flavor, and a soft texture. Besides enhancing the visual appearance, they also expand the possibilities for innovation in traditional culinary arts.

However, integrating microgreens into traditional Indonesian cuisine is not without challenges. From a production perspective, limited technical knowledge of cultivation and operational costs remain major obstacles (Rizkiyah et al., 2021). Uneven distribution contributes to the public's perception of microgreens as a new, high-end food ingredient, and their short shelf life keeps microgreen prices high.

Culinary developments in East and Southeast Asia demonstrate that local ingredients can be processed in modern ways without abandoning cultural identity. Exploring the potential of microgreens is relevant in efforts to transform Indonesian culinary aesthetics. Global trends such as the hyperlocal food movement and culinary innovation create opportunities for reflecting microgreens as ingredients in traditional Indonesian dishes (Yulistiyono et al., 2023). Furthermore, other global trends, such as farm-to-table and culinary wellness, encourage the integration of healthy and sustainable local ingredients into everyday menus. Therefore, making microgreens a symbol of innovation that maintains cultural roots is a fitting choice. This research aims to explore the potential of microgreens as an innovative ingredient in traditional Indonesian dishes through a literature review. The study focuses on identifying utilization opportunities, analyzing integration challenges, and exploring existing and potential culinary innovations to develop a conceptual foundation for healthy, competitive, and sustainable culinary development.

METHODS

The research adopted a descriptive qualitative method aimed at gaining an in-depth understanding of the topic through interpretative analysis rather than numerical data. Data collection was carried out through a literature review and documentation of relevant materials obtained from both national and international scientific journals. This approach allowed the researcher to gather a wide range of perspectives and findings from existing studies, which provided a rich foundation for analysis. The reviewed literature focused on three main areas: the opportunities for the utilization of culinary innovation, the challenges related to integration in various contexts, and the forms of culinary innovation that have been or are being developed with a forward-looking perspective. The selection of sources followed a purposive sampling technique, ensuring that only materials with high relevance to the research objectives were included. Particular attention was given to the credibility of the sources and the recency of their publication, to maintain the validity and timeliness of the information analyzed. By emphasizing these criteria, the study ensured that the data used were both authoritative and reflective of current developments in the field.

RESULTS AND DICUSSION

The Potential for Using Microgreens as an Innovative Ingredient in Indonesian Traditional Foods According to National and International Studies

Microgreens are young, nutrient-rich, and attractively presented herbs. A book on microgreens explains that these plants have a soft texture because they are harvested 7-14 days after germination, when the catholicon opens and the first leaf fully develops. These vegetables are harvested by cutting the plant to a length of 3-9 cm. These small vegetables are derived from the seeds of aromatic herbs, various vegetable species, and other edible wild plants.

First introduced to restaurant menus in California around 1992, microgreens were well-received by consumers (microgreen silo, 2022). Since then, people have become familiar with these vegetables and have begun experimenting with them in various dishes. Microgreens are now used as garnishes or as an ingredient in salads, soups, sandwiches, and other dishes. As a vegetable consumed fresh, microgreens are known to have a very high nutritional content. One

E-ISSN: 2776-1290, P-ISSN: 2776-1282

study found that microgreens contain at least 4 to 40 times more nutrients than mature vegetables.

In Asia, the use of microgreens such as shiso, daikon, and pak choi has become part of menu innovations in Thai, Japanese, and Korean cuisine, demonstrating that microgreens can be creatively integrated into traditional dishes without diminishing local culture (Future Menu 2025 SEA, Samyan Mitrtown, Bangkok). This opens up opportunities for Indonesian cuisine to adopt a similar approach, while maintaining local culture and wisdom.

Microgreens in Indonesian cuisine can be an innovative ingredient with great potential in terms of nutrition, aesthetics, and sustainability. Febriani et al. explain this makes microgreens ideal candidates for enhancing the functional value of traditional dishes such as pecel (vegetable salad), gado-gado (vegetable salad), and soto (vegetable soup). The beautiful shapes and colors of microgreens like red spinach, pea shoots, mung beans, and broccoli make dishes more attractive and appetizing.

The Main Challenges Faced in Integrating Microgreens into Local Indonesian Culinary Traditions, Both in Terms of Production, Distribution, and Consumer Acceptance

Despite its significant potential, the integration of microgreens into culinary cuisine faces several challenges in three main areas: production, distribution, and consumer acceptance. From a production perspective, limited land, technical knowledge, and initial investment costs are key obstacles. Febriana et al.'s research states that growing mung bean microgreens in cocopeat media produces the best growth and quality. However, this is not widely known by the public. In their journal, Rizkiyah et al. explain that microgreens differ from other conventional crops because they require a sterile growing medium and precise control of light, temperature, and humidity for full germination within 7-21 days. Excessive watering, unhygienic media, or poor seed quality can lead to crop failure, while the costs of organic fertilizer, specialized seeds, and seedling trays are quite high.

From a distribution perspective, microgreens are not yet widely available. Their delicate physical nature makes them susceptible to wilting and damage, requiring special and careful handling. Maintaining the quality and nutritional value of microgreens requires vacuum packaging and cold temperatures (Mir et al., 2017; Turner et al., 2020). Consequently, the travel time from farmers to consumers is short. Using equipment that maintains microgreen storage temperatures can increase transportation costs.

These factors contribute to the public's perception of microgreens, which often leads to them being perceived as a premium product. Currently, microgreens are still considered ornamental plants and ingredients in exclusive restaurants, rather than everyday items (Yanes-Molina et al., 2019; Verlinden, 2020). Based on information and promotions from several online stores, the price of microgreens ranges from IDR 25,000 to IDR 55,000 per gram, depending on the type of vegetable. This is due to the limited number of entrepreneurs and growers, both large-scale and home-based.

What Culinary Innovations Have Been and Can Be Developed through the Use of Microgreens in the Transformation or Modernization of Traditional Indonesian Food?

In terms of aesthetics and texture, microgreens have shapes and colors that enhance the beauty of Indonesian dishes. Their bright, attractive colors, soft texture, and light, fresh flavor make them acceptable to a wide range of ages (Suminar et al., 2025). The initial popularity of microgreens began with a chef serving them as a garnish or accompaniment to a main dish, adding aesthetic value and unique flavor (Delian et al., 2015; Turhan et al., 2024; Kim, et al., 2020).

In some restaurants, microgreens are still used as salad dressings, sandwich toppings, or smoothie mixes. However, as their popularity has grown, microgreens have been incorporated into dishes such as soto (Indonesian soup), rawon (Indonesian rawon), and gado-gado (Indonesian salad). Renna et al. (2017) tested microgreens as a base ingredient in sweet and

E-ISSN: 2776-1290, P-ISSN: 2776-1282

savory dishes. In spiced panna cotta and meat dishes, microgreens from chicory and red radish can add a dimension of flavor and aesthetics.

A chef at a fine-dining restaurant in Jakarta added microgreen extract to chili emulsifier and salad oil, creating a subtle, herbaceous flavor. Another innovative menu item uses microgreens as an additional ingredient in a gado-gado salad, combining cucumber, fried tofu, and tempeh with a peanut sauce dressing. Research on urban concepts developing microgreen broccoli (Febriana et al., 2019) found that several culinary innovators successfully created a "fusion oil" from broccoli microgreens, which was then adapted for Betawi soto (Indonesian soup) as an ingredient in coconut milk broth. The resulting soto broth appears pastel green and is high in antioxidants.

In fusion food menus, microgreens not only enhance flavor and appearance but also serve as an alternative vegetable substitute. From a gastronomic perspective, soilless microgreens produce customized microgreens tailored to the recipe and sensory requirements of the dish (Renna et al., 2017).

Global Trends and Culinary Practices in Asia Can Be A Reference for the Use of Microgreens in the Context of Indonesian Cuisine

Microgreens are not yet a popular food ingredient in Indonesia. Only a few places and certain groups are aware of their benefits. At several events hosted by global chefs, microgreens have been widely promoted as a nutritious food ingredient. Research indicates that unhealthy lifestyles and poor diets are very high in the 21st century, leading many people to suffer from malnutrition. Therefore, addressing this issue requires easy-to-grow and tasty foods. To achieve this, microgreens are considered a suitable food ingredient to meet people's nutritional needs.

An article discussing microgreens as a trending phenomenon in urban lifestyles emphasizes immediate access to fresh ingredients, farm-to-table, and contemporary dining experiences (Ramírez, 2024). Within this framework, microgreens are considered ideal due to their short cultivation cycle, minimal land requirements, and ability to grow in vertical or hydroponic systems in limited space, making them ideal for the farm-to-table concept, where microgreens can be grown directly in the kitchen or on rooftops. In fact, in some restaurants, microgreen plants are placed in visible areas. From a food science and molecular gastronomy perspective, microgreens have been proven to enhance the nutritional value of dishes without changing the basic recipe. They are adaptable to various processing methods (raw, infusion, emulsion), and supported by research that continues to map optimal varieties and growing conditions to maximize phytonutrients and flavor.

The vibrant colors typical of fresh plants, crunchy texture, and intense flavor are the sensory and functional appeal of microgreens. A proceeding journal on the Hyperlocal Food Movement in Urban Asia noted that local (Asian) microgreens, such as shiso, mizuna, and pea shoots, are used to add color and flavor to kaiseki dishes, banchan, or tom yam soup. In line with the principles of farm-to-table and urban farming, as well as local food security, the use of microgreens in Indonesian culinary arts presents a challenge. For example, red spinach microgreens are sprinkled in pecel sauce to increase vitamin C, and pea shoots are used as a filling in modern lemper to increase plant intake (Green, 2021). Basil microgreens are an additional vegetable in gado-gado roll. Broccoli microgreens are made with fusion oil and mixed in Betawi soto coconut milk sauce, providing an attractive pastel green color sensation and adding a soft herbal dimension.

CONCLUSION

Modern consumption trends demand food solutions that are not only nutritious but also environmentally friendly and oriented towards local wisdom. Microgreens have emerged as a crucial innovator. Fresh plants are harvested 7-21 days after germination. Their ability to grow quickly in limited space aligns with farm-to-table and urban farming principles, which reduce

E-ISSN: 2776-1290, P-ISSN: 2776-1282

carbon footprints and ensure local food security. Numerous journals examining the nutritional content of microgreens indicate that they possess a higher nutrient content compared to mature plants. This characteristic makes microgreens an ideal functional ingredient for enriching traditional Indonesian cuisine and gastronomy without altering the flavor profile. Challenges in integrating microgreens into local Indonesian culinary traditions include production, distribution, and consumer acceptance. To address these challenges, collaborative strategies are key: technical training for microgreen farmers, a hybrid distribution scheme (online and traditional markets) supported by cold packs, and a culinary narrative that embraces microgreens within traditional stories. By reducing production barriers, strengthening logistics, and building emotional connections with consumers, microgreens can prove to be more than just an aesthetic trend, but a bridge to a healthier, more sustainable, and more inclusive Indonesian cuisine. Innovative models for several traditional Indonesian dishes not only enhance their visual appearance and create plating options popular with young people, but also enhance their nutritional value and position Indonesian cuisine as a nutritious and sustainable commodity. Micro-enterprises in urban microgreen farming empower local communities, create new business opportunities, and spark cross-sector collaboration (chefs, urban farmers, and MSMEs) within a sustainable culinary ecosystem.

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