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Analysis of Bioactive Content in Indonesian Local Superfoods as a Preventative of Degenerative Diseases

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ABSTRACT

Degenerative diseases such as diabetes, cancer, and heart disease pose a major challenge to modern public health. One potential preventative measure is the use of local Indonesian superfoods rich in bioactive compounds. This study aims to identify the main bioactive compounds in various local Indonesian superfoods and explore their potential in preventing degenerative diseases. The research method used was a qualitative one with a literature study approach obtained from scientific journals, research reports, and interviews with nutritionists and food experts. Data analysis was conducted through content analysis with categorization of bioactives and their relationship to disease prevention mechanisms. The results showed that local superfoods such as moringa, tempeh, purple sweet potato, turmeric, ginger, mangosteen, guava, and soursop contain important bioactives such as flavonoids, polyphenols, isoflavones, anthocyanins, curcumin, gingerol, and acetogenins. These compounds act as antioxidants, anti-inflammatories, immunomodulators, and protective agents for cells, thus having significant potential in preventing degenerative diseases. These findings confirm that local Indonesian superfoods have strategic value not only as functional foods, but also as part of preventive public health efforts and national food sovereignty.

INTRODUCTION

Degenerative diseases, such as diabetes, cancer, hypertension, and heart disease, show a significant increasing trend globally along with changes in lifestyle, unhealthy eating patterns, and decreased physical activity, and this condition also poses a serious challenge to the health system in Indonesia which is now facing a prevalence of degenerative disease sufferers that is increasing from year to year (Sari, 2023).

An unhealthy diet is one of the main risk factors contributing to the increasing prevalence of degenerative diseases (Bahri & Prihartini, 2024), especially due to high consumption of fast food, low fiber intake, and the habit of consuming foods high in sugar, salt, and saturated fat which can trigger obesity, metabolic disorders, and long-term damage to body organs (Handayani, 2025).

Local Indonesian superfoods, such as moringa, tempeh, ginger, turmeric, purple sweet potato, and various tropical fruits, contain important bioactive compounds such as flavonoids, polyphenols, saponins, and carotenoids, which have been proven to have antioxidant and anti-inflammatory activities, as well as the ability to improve the body's

immune system (Putu Ayu Sri Devi et al., 2023). These bioactive compounds play a role in counteracting free radicals, lowering cholesterol levels, maintaining metabolic balance, and protecting cells from damage that can trigger degenerative diseases. This potential demonstrates that local superfoods not only possess high nutritional value but also have the potential to be developed as agents for the prevention of degenerative diseases while supporting the utilization of Indonesia's biodiversity for public health.

Unfortunately, this potential has not been widely published in depth in scientific literature or popularized through the media, so its existence is often less popular than imported superfoods such as chia seeds, quinoa, or blueberries, which are more intensively promoted globally (Naik et al., 2024). This situation has resulted in Indonesia's local superfoods receiving less attention, both in terms of research, product development, and their utilization in people's consumption patterns, even though their bioactive content is no less superior and has great potential to support the prevention of degenerative diseases and national food self-sufficiency (Ismail & Rudianto, 2024).

Qualitative analysis of the bioactive content of local superfoods is very important because it can reveal the health value contained therein, while also providing a strong scientific basis for wider use in people's consumption patterns (Graeff-Hönninger & Khajehei, 2019). Through in-depth studies, the potential of bioactives such as flavonoids, polyphenols, saponins, and carotenoids can be mapped for their role in preventing degenerative diseases, so that local superfoods are seen not only as traditional foods but also as part of modern health solutions. Furthermore, this research can strengthen national food sovereignty by increasing appreciation for Indonesia's biological wealth, encouraging innovation in locally-based foods, and reducing dependence on imported superfoods, which have been more dominant in the market (Prayuda, 2020).

Most existing research focuses on imported superfoods and their health effects, while studies on local Indonesian superfoods tend to be partial, highlighting only one specific commodity without integrating it into a comprehensive framework. This leaves knowledge about the bioactive potential of various local superfoods fragmented and underutilized. Furthermore, systematic qualitative studies exploring the bioactive content of local superfoods and their relevance to preventing degenerative diseases are still very limited. This situation indicates a research gap that needs to be bridged through more in-depth, integrated, and comprehensive studies to strengthen the scientific basis and expand the use of local superfoods as part of national health and food sovereignty strategies (Suardiani et al., 2025).

The novelty of this research lies in its attempt to provide a new synthesis of the bioactive content of various local Indonesian superfoods by presenting a more holistic analysis of the relationship between these bioactives and their potential for preventing degenerative diseases. This study not only combines various previously fragmented research findings but also presents a comprehensive perspective that can demonstrate the strategic role of local superfoods in public health. Furthermore, this research encourages recognition of local Indonesian superfoods as a healthy, globally competitive food alternative, while strengthening Indonesia's position in utilizing its biological wealth for health and food security.

The purpose of this study is to identify various types of local Indonesian superfoods rich in bioactive compounds, analyze their main bioactive components such as flavonoids, polyphenols, saponins, and other compounds, and explore their potential as agents for preventing degenerative diseases. Furthermore, this study aims to provide

scientific insights that can strengthen the basis for the use of local superfoods in healthy diets while contributing to public health promotion efforts, thereby supporting improved quality of life and food self-sufficiency in Indonesia.

METHODOLOGY

This research method uses a qualitative approach with an exploratory study focused on an in-depth understanding of the bioactive content of local Indonesian superfoods and their potential in preventing degenerative diseases. This type of research is a qualitative literature study, both systematic literature reviews and narrative reviews, which can be supplemented with interviews with experts such as nutritionists, herbalists, and food technologists to strengthen the validity of the data. Research data sources include scientific journal articles, books, research reports, and relevant health documents, as well as key informants from nutrition experts, food experts, and traditional health practitioners. Data collection techniques are carried out through literature studies by searching scientific databases (Scopus, PubMed, Google Scholar), semi-structured interviews with experts when necessary, and documentation of secondary data related to the bioactive composition and health benefits of local superfoods. Research instruments include interview guidelines, data recording sheets from literature results, and reference management software such as Mendeley or Zotero.

Data analysis used content analysis to identify themes of bioactive content and health benefits, with data categorization based on bioactive types (flavonoids, polyphenols, saponins, etc.) and their relationship to the prevention of degenerative diseases, as well as data triangulation from literature, interviews, and documents to increase the credibility of the results. Data validity was obtained through source and method triangulation techniques, member checking with expert informants, and peer debriefing with researchers or experts in the field of nutrition and food (Bell et al., 2022). The research was conducted using desk research through libraries and online databases with an estimated time of approximately 2–3 months depending on the period of literature collection and analysis.

RESULTS AND DISCUSSION

Research shows that various local Indonesian superfoods contain diverse bioactive compounds that are beneficial for health. Moringa is known to be rich in flavonoids, vitamin C, and polyphenols; tempeh contains isoflavones, probiotics, and high protein; purple sweet potato has high levels of anthocyanins with antioxidant properties; turmeric contains curcumin, which acts as an anti-inflammatory; ginger is rich in gingerols and shogaols with antioxidant activity; while tropical fruits such as snake fruit, mangosteen, guava, and soursop contain polyphenols, tannins, and vitamins essential for the body.

From the analysis of the main bioactive components, it was found that flavonoids and polyphenols act as antioxidants that can neutralize free radicals, saponins function to lower cholesterol levels, isoflavones have a protective role against heart disease and cancer, curcumin works as an anti-inflammatory agent and cellular protector, and anthocyanins contribute to improving cognitive function and delaying the cellular aging process. These findings show that the bioactives in local superfoods have complementary mechanisms of action in supporting body health.

The potential of these bioactive compounds is highly relevant in preventing degenerative diseases. In diabetes, bioactive compounds function to reduce insulin

resistance; in cancer, polyphenols, flavonoids, and curcumin can inhibit cancer cell proliferation; in heart disease, saponins and isoflavones help regulate lipid metabolism; and in Alzheimer's disease, anthocyanins and flavonoids play a role in improving cognitive function. This confirms that local Indonesian superfoods have great potential as alternative functional foods to support public health and reduce the risk of degenerative diseases.

Table 1: Bioactive Content of Indonesian Local Superfoods and Their Preventive Potential Against Degenerative Diseases

Local Superfood	Main Bioactive Ingredients	Main Mechanism/Role	Potential for Preventing Degenerative Diseases
Moringa (Moringa oleifera)	Flavonoids, polyphenols, vitamin C	Antioxidant, anti-inflammatory	Reduce the risk of diabetes, hypertension, cancer
Tempeh (Fermented Soybean)	Isoflavones, probiotics, high protein	Hormonal regulation, increased immunity, lipid balance	Prevention of heart disease, breast cancer, osteoporosis
Purple Sweet Potato (Ipomoea batatas L.)	Anthocyanin	Powerful antioxidant, neuroprotective	Reduces the risk of Alzheimer's, improves cognitive function
Turmeric (Curcuma longa)	Curcumin	Anti-inflammatory, antioxidant, cell protection	Prevention of cancer, arthritis, liver disorders
Ginger (Zingiber officinale)	Gingerol, shogaol	Antioxidant, anti-inflammatory, improves metabolism	Prevention of colon cancer, heart disease, diabetes
Mangosteen (Garcinia mangostana)	Xanthones, tannins, polyphenols	Powerful antioxidant, immunomodulator	Prevention of cancer, premature aging, hypertension
Guava (Psidium guajava)	Lycopene, vitamin C, flavonoids	Antioxidant, anti-inflammatory	Prevention of prostate cancer, cardiovascular disease
Soursop (Annona muricata)	Acetogenin, flavonoid	Cytotoxic against cancer cells	Cancer prevention, increase immunity

Source: 2025 Data Processing Results

The table above shows that local Indonesian superfoods contain a wide variety of bioactive compounds, ranging from flavonoids, polyphenols, and anthocyanins to specific compounds such as curcumin, gingerol, and acetogenin. These bioactive compounds have mechanisms of action closely related to the prevention of degenerative diseases, including antioxidant, anti-inflammatory, immunomodulatory, and lipid and

hormone metabolism regulation. For example, moringa and guava are rich in flavonoids and vitamin C, which play a role in reducing the risk of hypertension and cancer, while tempeh, with its isoflavone and probiotic content, contributes to heart health and hormonal balance. Purple sweet potato, with its anthocyanins, has been shown to have neuroprotective effects that can prevent Alzheimer's, while turmeric and ginger contain active compounds that can reduce chronic inflammation and the risk of cardiometabolic disease. Thus, local Indonesian superfoods not only serve as daily foods but also have great potential as competitive degenerative disease preventative agents compared to imported superfoods.

The Relevance of Local Superfoods to Health

Local Indonesian superfoods have the same potential, and in some aspects can even be said to be higher than imported superfoods, both in terms of bioactive content and health benefits (Sri Mulyati et al., 2024). Various studies have shown that moringa, tempeh, turmeric, ginger, purple sweet potato, and various tropical fruits have concentrations of bioactive compounds that are no less superior than chia seeds, quinoa, or blueberries, which are currently more popular in the global market. In addition to being rich in antioxidants, anti-inflammatory agents, and essential nutrients, local superfoods are also more accessible, lower cost, and suited to the cultural context and consumption patterns of Indonesians. These advantages make local superfoods not only beneficial for health but also have the potential to strengthen national food self-sufficiency, reduce dependence on imported products, and open up significant opportunities for the development of an internationally competitive functional food industry (Mallu et al., 2025).

The bioactive content in superfoods has been proven to have an important role in supporting preventive health by reducing the risk of various degenerative diseases (Naik et al., 2024). Compounds such as flavonoids, polyphenols, saponins, isoflavones, curcumin, and anthocyanins work through antioxidant, anti-inflammatory, metabolic regulation, and cellular protection mechanisms that can inhibit premature aging and organ damage (Sobhani et al., 2021). Thus, consuming superfoods rich in bioactive compounds can be an effective strategy for maintaining balanced bodily functions, increasing resistance to oxidative stress, and reducing the potential for developing chronic diseases such as diabetes, cancer, hypertension, heart disease, and cognitive impairment.

The Benefits of Local Superfoods

Local Indonesian superfoods have the main advantage of being easily accessible and more economical compared to imported superfoods, which are relatively expensive and require large distribution costs (Muslimah et al., 2025). Their abundant availability in various regions makes local superfoods more accessible to people from all walks of life, allowing them to be widely utilized as part of daily diets. This not only supports public health through the consumption of functional foods rich in bioactives but also encourages the creation of an inclusive, healthy lifestyle without cost or limited access (Nurul, 2025).

Furthermore, the consumption of local superfoods aligns with the local wisdom and dietary habits of Indonesians, who have long been familiar with various traditional foods such as moringa, tempeh, turmeric, ginger, and purple sweet potato. Utilizing these commodities not only strengthens cultural identity but also opens up significant

opportunities to boost the local economy through the development of processed products, the functional food industry, and community-based marketing (Rando et al., 2025). By optimizing the added value of local superfoods, communities not only gain health benefits but also encourage the growth of a highly competitive creative economy sector, both nationally and internationally.

Comparison with Previous Research

Previously, research on local superfoods in Indonesia focused on a single aspect, such as examining the curcumin content of turmeric or the anthocyanin content of purple sweet potatoes. Therefore, the results were partial and did not provide a comprehensive picture. While such studies make important contributions to understanding the specific benefits of individual bioactive compounds, they are insufficient to fully assess the potential of local superfoods as agents for preventing degenerative diseases (Susanti & Kurniati, 2025).

In contrast to previous research, this study emphasizes a more comprehensive synthesis by combining various findings regarding the bioactive content of various local Indonesian superfoods (Setyawan et al., 2023). The research focuses on a holistic analysis linking bioactive compounds such as flavonoids, polyphenols, saponins, isoflavones, curcumin, and anthocyanins with their role in preventing degenerative diseases. This approach is expected to provide a stronger scientific basis for promoting local superfoods as functional foods that not only benefit health but also have strategic value in supporting food security and health independence for the Indonesian people (Popova et al., 2024).

The practical implication of this research is that the findings regarding the bioactive content of local Indonesian superfoods can serve as a basis for local food-based health promotion. By providing scientific evidence regarding the benefits of local superfoods, communities can be encouraged to integrate traditional foods into their daily diets as a preventive strategy against degenerative diseases (Gupta & Mishra, 2021). Furthermore, the results of this study support the efforts of the government and policymakers in formulating public health programs that emphasize the importance of balanced nutrition and the utilization of local food potential.

Furthermore, this research is also relevant to food sovereignty policy by confirming that Indonesia possesses a rich biodiversity that can be utilized as natural health solutions without relying on imported products. This aligns with sustainable development strategies that emphasize the use of local resources to support health while strengthening national food security. Furthermore, the research findings open up significant opportunities for the development of a functional food and health supplement industry based on local superfoods, which not only benefits public health but also enhances the competitiveness of Indonesian products in the global market.

However, this study has several limitations. The data used still relies heavily on secondary literature and expert interviews, thus not fully reflecting empirical evidence of direct human consumption of local superfoods. The lack of direct clinical trials poses a challenge in practically demonstrating the effectiveness of bioactives in humans. Therefore, further research using quantitative approaches, including laboratory tests and clinical trials, is urgently needed to validate the bioactive content and strengthen the scientific basis for the role of local superfoods in preventing degenerative diseases.

CONCLUSION

Indonesian local superfoods have been shown to be rich in bioactive compounds such as flavonoids, polyphenols, isoflavones, anthocyanins, curcumin, gingerol, and acetogenin, which play a vital role in health through antioxidant, anti-inflammatory, immunomodulatory, and lipid and hormone metabolism regulation mechanisms relevant to the prevention of degenerative diseases. Each local superfood has specific advantages, for example, purple sweet potato with its anthocyanins for neuroprotection, tempeh with its isoflavones for heart and hormonal health, and turmeric with its curcumin for cancer and inflammation prevention. However, the potential of local superfoods as degenerative disease preventative agents has not been fully utilized and is still less popular than imported superfoods. However, the use of local superfoods not only supports public health but also has strategic value in strengthening food sovereignty and increasing the competitiveness of local commodities in the global market. Therefore, further research, both experimental and clinical, is urgently needed to strengthen scientific evidence and support the development of local superfoods into functional food products that meet international standards.

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