



UTILIZATION OF FUNCTIONAL FOOD BASED ON BREADFULNESS (*ARTOCARPUS ALTILIS*) AS A SOURCE OF ANTIOXIDANTS IN DIABETES MELLITUS: LITERATURE REVIEW

Ayu Putri*, Helmizar, Syahril

Faculty of Public Health, Universitas Andalas, Limau Manis, Pauh, Padang, Sumatera Barat 25163, Indonesia

*yuputri.1994@gmail.com

ABSTRACT

Diabetes mellitus is a chronic metabolic disease characterized by hyperglycemia due to impaired carbohydrate, protein, and fat metabolism. One common symptom experienced by sufferers is polyphagia (increased hunger) caused by impaired energy utilization due to suboptimal insulin function. Furthermore, oxidative stress resulting from high blood sugar levels can exacerbate insulin resistance. Therefore, the use of functional foods high in antioxidants is a potential strategy for diabetes management. Breadfruit (*Artocarpus altilis*) is known to contain bioactive compounds such as flavonoids, polyphenols, and quercetin, which have antioxidant activity. This study aims to assess the potential of breadfruit as a functional food source of antioxidants in the management of diabetes mellitus based on the results of recent research. This study employed a literature review to examine the utilization of breadfruit (*Artocarpus altilis*) as a functional food rich in antioxidants for the management of diabetes mellitus. Data were obtained from Google Scholar, ScienceDirect, and PubMed using the keywords “functional foods,” “breadfruit,” “*Artocarpus altilis*,” “antioxidants,” “diabetes mellitus,” “oxidative stress,” and “hyperglycemia,” with a publication period limited to 2020–2025. Articles were then screened based on relevance, full-text availability, and suitability with the research objectives. A total of 45 articles were identified, of which 20 met the inclusion criteria, and 4 articles were analyzed further. The review showed that breadfruit leaf extract was able to lower triglyceride levels and increase total sperm count in diabetic rats. Furthermore, breadfruit pulp extract was shown to lower blood glucose levels. The combination of breadfruit flour and red bean flour also has the potential to modulate the atherogenic index in diabetic rats. The therapeutic mechanisms of breadfruit are thought to involve antioxidant activity, increased insulin sensitivity, and modulation of lipid metabolism. Breadfruit has potential as a functional food to help control diabetes mellitus and its complications. However, further research is needed to determine the optimal dosage, safety, and molecular mechanisms in greater depth.

Keywords: antioxidants; breadfruit; breadfruit leaves; diabetes mellitus; functional food

How to cite (in APA style)

Putri, A., Helmizar, H., & Syahril, S. (2026). Utilization of Functional Food Based on Breadfulness (*Artocarpus Altilis*) as A Source of Antioxidants in Diabetes Mellitus: Literature Review. *Indonesian Journal of Global Health Research*, 8(2), 1145–1150. <https://doi.org/10.37287/ijghr.v8i2.1845>.

INTRODUCTION

Diabetes mellitus is a chronic metabolic disease characterized by persistently elevated blood glucose levels (hyperglycemia) due to impaired carbohydrate, protein, and fat metabolism related to impaired insulin secretion and insulin action. This disease is a global health problem, with its prevalence increasing annually. According to the International Diabetes Federation (IDF), the number of people with diabetes continues to increase significantly worldwide (Magliano & Boyko, 2021). Furthermore, the American Diabetes Association states that diabetes mellitus is associated with various serious complications such as cardiovascular disease, neuropathy, and nephropathy (ADA, 2021). Diabetes mellitus is influenced by various risk factors, both modifiable and non-modifiable. These factors include age, low physical activity, smoking, stress, an unhealthy lifestyle, hypertension, and obesity. The combination of these factors can worsen insulin resistance and increase the risk of developing type 2 diabetes (Jiang et al., 2024).

Common symptoms of type 2 diabetes mellitus include polyuria (frequent urination), polydipsia (frequent thirst), and polyphagia (excessive hunger). Polyphagia is a condition of increased appetite accompanied by weakness. This occurs because glucose cannot enter cells optimally due to

impaired insulin function, resulting in cells experiencing energy deprivation despite high blood glucose levels. As a result, the body responds by increasing hunger as a compensatory measure (Prawitasari, 2019).

In addition to metabolic disorders, diabetes mellitus is also closely linked to increased oxidative stress. Chronic hyperglycemia can trigger the production of excessive amounts of free radicals, which cause cell and tissue damage and worsen insulin resistance. Oxidative stress plays a key role in the development of diabetes complications, so efforts to suppress the effects of free radicals through antioxidant intake are necessary (Helmalia et al., 2019; Trigo et al., 2023). One approach is through the development of functional foods. Functional foods are foods that not only meet basic nutritional needs but also provide additional health benefits, including the prevention and management of chronic diseases such as diabetes mellitus (Lee et al., 2024). Utilizing local food ingredients rich in antioxidants is a potential alternative for development.

Breadfruit (*Artocarpus altilis*) is a local Indonesian plant with great potential as a functional food. Breadfruit contains various bioactive compounds such as flavonoids, polyphenols, and quercetin, which act as powerful antioxidants in scavenging free radicals (Noer Aza Fauzian et al., 2025). Furthermore, breadfruit is also rich in complex carbohydrates and fiber, which can help control blood glucose levels (Sri W, 2008). Several studies have shown that breadfruit has therapeutic effects on diabetes. Breadfruit leaf extract has been reported to lower triglyceride levels and improve certain biological parameters in animal models of diabetes (Triandini et al., 2024; Widiastuti, 2023). Furthermore, breadfruit pulp extract has been shown to be effective in lowering blood glucose levels in diabetic test animals (Damri, 2024). Combining breadfruit flour with other food ingredients, such as red bean flour, has also shown potential in improving lipid profiles by reducing the atherogenic index (Aprilia et al., 2021).

With its high antioxidant content, breadfruit has the potential to help reduce oxidative stress, increase insulin sensitivity, and improve energy metabolism. Furthermore, the use of breadfruit as a functional food ingredient is expected to help address symptoms of polyphagia by providing a more stable energy source for the body. Therefore, this study aims to analyze the potential of breadfruit (*Artocarpus altilis*) as a functional food rich in antioxidants in the management of diabetes mellitus based on recent scientific evidence.

METHOD

This study used a literature review approach to examine various research findings related to the use of breadfruit (*Artocarpus altilis*)-based functional foods as a source of antioxidants in the management of diabetes mellitus. The data analysis process involved four main stages: organization, synthesis, identification, and further analysis of relevant research findings. Literature sources included national and international publications obtained from three major databases: Google Scholar, ScienceDirect, and PubMed. Articles were searched using the keywords "functional foods," "breadfruit," "*Artocarpus altilis*," "antioxidants," "diabetes mellitus," "oxidative stress," and "hyperglycemia."

The publication period was limited to 2020–2025 to ensure that the collected evidence reflected the latest and most relevant scientific developments. All retrieved articles were then downloaded using Mendeley Desktop version 1.19.8, and duplicates were manually removed before further screening. The article selection process was conducted systematically based on the relevance of the title and abstract, the availability of full text, and its suitability to the research objectives. The inclusion criteria for this study were as follows:

1. Research articles discussing the use of breadfruit (*Artocarpus altilis*) as a functional food or antioxidant source in the management of diabetes mellitus.
2. Research involving human subjects or animal models of diabetes.
3. Articles published between 2020 and 2025 and written in Indonesian or English.

4. Articles available in full text and with a clear research methodology.

The exclusion criteria for this study included:

1. Articles that do not specifically discuss breadfruit or are not related to antioxidant activity in diabetes mellitus.
2. Studies focusing on topics other than diabetes mellitus, such as non-metabolic diseases.
3. Articles that do not present quantitative data or measurable results related to antioxidant effects or diabetes management.
4. Non-scientific publications such as opinion pieces, editorials, proceedings, or narrative reviews without clear data analysis.

Articles meeting the inclusion criteria were then included in the final analysis. Each article was classified based on key research information, including author names, year of publication, study design, study location, sample characteristics, and key findings related to antioxidant activity and its effects on diabetes mellitus.

RESULT

This study used a literature review approach to assess the effectiveness of breadfruit-based functional food as a high-antioxidant ingredient for controlling blood sugar levels in patients with diabetes mellitus. A literature search was conducted through several scientific databases using relevant keywords, resulting in 324 articles in the initial identification stage. Based on the selection results, five articles were identified as relevant and met the inclusion criteria for analysis in this study.

Table 1.

Description of research on the use of breadfruit as a source of antioxidants in diabetes mellitus

Title/ Author (Year)	Study Design	Population and Sample	Findings
<i>The effect of breadfruit leaf extract (Artocarpus altilis F.) on the total number of spermatozoa in diabetes mellitus model rats (Triandini et al., 2024)</i>	experiment	Population: Diabetes mellitus model mice. Sample: Mice divided into control and treatment groups.	There was a significant difference ($p < 0.05$) between the control and treatment groups. The 200 mg/kgBW dose showed the best effect in increasing sperm count.
<i>The effect of administering a combination formula of red bean flour and breadfruit flour on the atherogenic index of diabetic rats (Aprilia et al., 2021)</i>	experiment	Population: Diabetic rats. Sample: Rats fed a combination of red bean flour and breadfruit flour.	There was an influence on the atherogenic index, although not statistically significant ($p > 0.05$), but showed a tendency for improvement.
<i>Testing the effectiveness of ethanol extract and ethyl acetate fraction of breadfruit flesh on reducing blood sugar levels in diabetic mice (Damri, 2024)</i>	Experiment	Population: Diabetic mice. Sample: Mice given varying doses of extract.	The dose and duration of administration have a significant effect on reducing blood sugar, with a dose of 100 mg/kgBW showing the best results.
<i>The effect of breadfruit leaf extract on triglycerides and blood pressure in outpatients with type 2 diabetes mellitus at the Biru Community Health Center, Bone Regency (Widiastuti, 2023)</i>	Clinical experiment	Population: Type 2 diabetes mellitus patients. Sample: 46 patients	There was a significant decrease in triglyceride levels in the intervention group compared to the control group.

Based on the identification results, all research findings show that providing breadfruit-based ingredients, both from leaves and fruit, is high in antioxidants and can control blood sugar levels.

DISCUSSION

Breadfruit (*Artocarpus altilis*)-based functional foods demonstrate significant potential in the management of diabetes mellitus, particularly through their effects on glycemic control and metabolic parameters. Based on the four selected studies, both breadfruit leaves and pulp consistently show beneficial effects in diabetic conditions. Breadfruit leaf extract has been reported to improve biological parameters, including increasing spermatozoa count in diabetic animal models (Triandini et al., 2024), as well as significantly reducing triglyceride levels in patients with type 2 diabetes mellitus (Widiastuti, 2023). These findings indicate that breadfruit not only affects glucose metabolism but also contributes to improving reproductive and lipid profiles. In addition, breadfruit pulp extract has demonstrated a significant hypoglycemic effect by lowering blood glucose levels in diabetic mice (Damri, 2024).

The combination of breadfruit flour and red bean flour also showed a tendency to improve the atherogenic index, although the results were not statistically significant (Aprilia et al., 2021). This finding suggests that while breadfruit has promising metabolic effects, its efficacy may depend on dosage, formulation, and duration of intervention. Similar findings have been reported in recent primary studies, which indicate that plant-based functional foods rich in antioxidants and dietary fiber can improve lipid profiles and reduce cardiovascular risk in individuals with diabetes (Jiang et al., 2024; Lee et al., 2024). Therefore, breadfruit can be positioned as a potential nutraceutical agent that targets both glycemic control and lipid metabolism.

From a mechanistic perspective, the antidiabetic effects of breadfruit are strongly associated with its bioactive compounds, including flavonoids, polyphenols, quercetin, and chlorogenic acid. These compounds act as potent antioxidants that neutralize free radicals and reduce oxidative stress, which plays a central role in the pathogenesis of diabetes mellitus and insulin resistance (Trigo et al., 2023; Adeyemi et al., 2021). Chronic hyperglycemia is known to increase the production of reactive oxygen species (ROS), leading to cellular damage and impaired insulin signaling. By reducing oxidative stress, these bioactive compounds help restore insulin sensitivity and improve glucose uptake in peripheral tissues.

Furthermore, antioxidants derived from breadfruit have been shown to protect pancreatic β -cells from oxidative damage, thereby preserving insulin secretion capacity. This is particularly important in the progression of type 2 diabetes mellitus, where β -cell dysfunction is a key pathological feature. Recent studies also highlight that plant-derived antioxidants can modulate intracellular signaling pathways related to glucose metabolism and inflammation, further supporting their therapeutic role in diabetes management (Mehta et al., 2023; Lee et al., 2024).

In addition to antioxidant activity, breadfruit also exerts its antidiabetic effects through the inhibition of carbohydrate-digesting enzymes such as α -amylase and α -glucosidase. This mechanism slows down the digestion and absorption of carbohydrates, leading to a more gradual increase in blood glucose levels and preventing postprandial hyperglycemia. This effect is particularly beneficial in managing glycemic variability, which is a major challenge in diabetes care. Similar enzyme inhibitory activities have been reported in other plant-based functional foods, reinforcing the role of dietary interventions in diabetes management (Adeyemi et al., 2021).

Moreover, the high fiber content in breadfruit contributes to improved glycemic control by delaying gastric emptying and enhancing satiety, which may help reduce symptoms such as polyphagia. A more stable release of glucose into the bloodstream can prevent sudden spikes and drops in blood sugar levels, thereby improving overall metabolic balance. This aligns with recent findings that emphasize the importance of dietary fiber in regulating glucose homeostasis and improving insulin sensitivity (Jiang et al., 2024).

From a lipid metabolism perspective, the reduction in triglyceride levels and the potential improvement in the atherogenic index observed in the reviewed studies suggest that breadfruit may also play a role in reducing cardiovascular risk in diabetic patients. Cardiovascular complications are a major cause of morbidity and mortality in diabetes mellitus, and interventions that improve lipid profiles are highly valuable. The antioxidant and anti-inflammatory properties of breadfruit compounds may contribute to these effects by reducing lipid peroxidation and improving vascular function (Trigo et al., 2023).

However, despite these promising findings, several limitations must be considered. The number of studies included in this review is relatively small, and most of the evidence is derived from animal models. Only one study involved human subjects, which limits the generalizability of the findings. In addition, variations in study design, dosage, and forms of breadfruit (leaf extract, pulp extract, flour) contribute to heterogeneity in the results. Therefore, further research, particularly well-designed clinical trials in humans, is needed to confirm the efficacy, safety, and optimal dosage of breadfruit as a functional food in diabetes management.

CONCLUSION

This literature review found that the use of breadfruit (*Artocarpus altilis*) leaves and fruit as functional foods has therapeutic potential in the management of diabetes mellitus and its complications. Breadfruit has been shown to lower blood sugar levels. This therapeutic effect is thought to originate from the content of bioactive compounds such as flavonoids, polyphenols, and chlorogenic acid, which have antioxidant activity, increase insulin sensitivity, and modulate lipid metabolism.

REFERENCES

- American Diabetes Association. (2021). Standards of medical care in diabetes—2021. *Diabetes Care*, 44(Suppl. 1), S1–S232.
- Adeyemi, O. S., Sulaiman, F. A., & Akanji, M. A. (2021). Antioxidant and antidiabetic properties of *Artocarpus altilis*. *Journal of Functional Foods*, 85, 104642.
- Aprilia, N., et al. (2021). Effect of a combination of red bean flour and breadfruit flour on the atherogenic index of diabetic rats.
- Ceriello, A., & Motz, E. (2020). Oxidative stress and insulin resistance. *Diabetes Care*, 27(11), 2568–2574.
- Culetu, A., Susman, I. E., Duta, D. E., & Belc, N. (2021). Nutritional and functional properties of gluten-free flours. *Applied Sciences*, 11(14), 6283.
- Damri, M. (2024). Testing the effectiveness of ethanol extract and ethyl acetate fraction of breadfruit (*Artocarpus altilis*) flesh on reducing blood sugar levels in diabetic mice (Undergraduate thesis). Dharma Andalas University.
- Helmalia, A. W., Putri, D., & Dirpan, A. (2019). The potential of traditional spices as a source of natural antioxidants for functional food raw materials. *Canrea Journal: Food Technology, Nutrition, and Culinary Journal*, 26–31.
- Jiang, R., Cong, Z., Zheng, L., Zhang, L., Guan, Q., Wang, S., et al. (2024). Global research trends in regulating the gut microbiome to improve type 2 diabetes mellitus: Bibliometric and visual analysis. *Frontiers in Endocrinology*, 15, 1401070.
- Lee, J. H., Kim, M. J., & Kim, C. Y. (2024). The development of new functional foods and ingredients. *Foods*, 13(19), 3038.
- Magliano, D. J., & Boyko, E. J. (2021). *IDF diabetes atlas (10th ed.)*. International Diabetes Federation.
- Mehta, K. A., Quek, Y. C. R., & Henry, C. J. (2023). Breadfruit (*Artocarpus altilis*): Nutritional quality and food applications. *Frontiers in Nutrition*, 10, 1156155.
- Noer Aza Fauzian, N., Prametha, N. M., Mardiyana, M., & Handayani, M. (2025). Optimizing the potential of breadfruit as a local food ingredient in achieving national food security. *Journal of Food Technology and Agroindustry*, 5(1), 1–10.

- Prawitasari, D. S. (2019). Diabetes mellitus and antioxidants. *Keluwith: Journal of Health and Medicine*, 1(1), 48–52.
- Sri, W. (2008). Prospects of breadfruit (*Artocarpus communis*) as a carbohydrate source in supporting food consumption diversification. *Food Journal*, 8(56), 67–75.
- Triandini, R., et al. (2024). Effect of breadfruit (*Artocarpus altilis*) leaf extract on total spermatozoa count in a rat model of diabetes mellitus.
- Trigo, M., Paz, D., Bote, A., & Aubourg, S. P. (2023). Antioxidant activity of an aqueous extract of cuttlefish ink during fish muscle heating. *Antioxidants*, 12(11), 1996.
- Widiastuti, A. (2023). The effect of breadfruit leaf extract on triglycerides and blood pressure in type 2 diabetes mellitus patients (Undergraduate thesis).
- Widowati, S., Amiarsi, D., & Nurlaela, R. S. (2020). Reduction of compounds causing bitter taste in breadfruit flour processing. *Journal of Halal Food Science*, 1(2), 59–65