



Synergistic Activity of Dayak Onion and Halalang as Multi-Target Antidiabetic

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ABSTRACT

*Diabetes mellitus (DM) is a chronic metabolic disease characterized by hyperglycemia due to impaired insulin secretion and/or action. The increasing global (approx. 589 million adults) and national (11.7% in Indonesia in 2023) prevalence highlights the critical need for effective therapies. This urgency drives the search for local alternatives like *Eleutherine palmifolia* (Dayak Onion) and *Imperata cylindrica* (Cogon Grass), traditionally used to control blood glucose. This review aims to examine their antidiabetic activity, identify multi-target mechanisms, and explore their potential synergy on insulin sensitivity. The method employed a narrative literature review of 23 scientific articles (2013–2025) sourced from PubMed, ScienceDirect, Google Scholar, and ResearchGate. Results show *E. palmifolia* lowers blood glucose and improves insulin resistance through pancreatic β -cell regeneration, α -glucosidase inhibition, and antioxidant activity. *I. cylindrica* reduces oxidative stress and enhances glucose utilization via anti-inflammatory mechanisms and improved mitochondrial function. In conclusion, the combination offers potential for a stronger synergistic effect in improving insulin sensitivity and blood glucose control. Recommendations include essential further testing through in vivo combination trials and toxicity tests to prove safety and effectiveness. Furthermore, in-depth exploration of molecular pathways (e.g., GLUT4, AMPK, insulin gene expression) is required to clarify the synergistic mechanism*

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INTRODUCTION

Diabetes Mellitus is a chronic metabolic disease characterized by hyperglycemia due to impaired insulin secretion and/or action (Haryadi, 2023)). According to the International Diabetes Federation (International Diabetes Federation, 2023) approximately 589 million adults worldwide live with diabetes, and this number is expected to continue to grow in the coming years. In Indonesia, the prevalence of diabetes reaches approximately 11.3%, equivalent to 20 million adults (International Diabetes Federation, 2024) Data from the Indonesian Ministry of Health (2023) also shows an increase in diabetes prevalence from 10.9% in 2018 to 11.7% in 2023. This condition indicates that diabetes mellitus remains a serious health problem and requires effective prevention and therapy strategies. At the

local level, East Kalimantan Province also faces a significant challenge in diabetes prevalence. Based on the 2018 Basic Health Research (Riskesdas), the prevalence of diabetes mellitus diagnosed by doctors in East Kalimantan was approximately 1.76% of the total population. In East Kalimantan, the potential of local plants as antidiabetic agents is very interesting, considering the richness of flora and herbal medicine traditions in the Dayak community (Kemenkes RI, 2023)

Two typical plants of East Kalimantan, namely Dayak Onion (*Eleutherine palmifolia* / *E. bulbosa*) and Halalang (*Imperata cylindrica*), have traditionally been used to manage diabetes (Arwati *et al.*, 2018; Kumalasari *et al.*, 2020) Modern research has shown that Dayak Onion extract can lower glucose levels and exhibit antioxidant activity, with mechanisms involving inhibition of the α -glucosidase enzyme and protection of pancreatic cells from oxidative damage (Ahmad *et al.*, 2017; Syariful Anam *et al.*, 2025) Studies in diabetic rat models have shown that Dayak Onion extract can control hyperglycemia and prevent long-term diabetes complications (Arwati *et al.*, 2018; Yaturramadhan, Dalimunthe and Widyawati, 2019) Recent research indicates that *Eleutherine palmifolia* has the potential to improve insulin sensitivity and lower blood glucose levels in animal models of diabetes, while specific evidence for *Imperata cylindrica* on insulin sensitivity is limited, although there are indications of antidiabetic effects through antioxidant and glucose-lowering activities.

Eleutherine palmifolia and *Imperata cylindrica* are two plants native to East Kalimantan that are traditionally used to manage diabetes. Modern research highlights the multi-target potential of these two herbs, particularly in lowering blood glucose, increasing insulin, and protecting cells from oxidative stress (Ahmad *et al.*, 2017; Tahadjou *et al.*, 2024; Syariful Anam *et al.*, 2025)

Meanwhile, antidiabetic evidence for Halalang is relatively limited, but preliminary results indicate that *Imperata cylindrica* root extract can lower blood sugar in animal models, improve lipid profiles, lower HbA1c, and even induce pancreatic cell regeneration (Unuofin and Lebelo, 2020a; Tahadjou *et al.*, 2024) Photochemistry of the extract indicates flavonoid content that may play a role in modulating glucose transporters, stimulating insulin secretion, and reducing oxidative stress and insulin resistance (Syariful Anam *et al.*, 2025) Despite their respective potentials, there are not many studies comprehensively examining the synergy between Dayak Onion and Halalang in regulating glucose and insulin sensitivity, as well as protecting pancreatic β -cells. Therefore, this paper aims to critically review the current scientific evidence regarding these two plants, explore their multi-target mechanisms, and propose an integrative research model to evaluate their antidiabetic synergy. The primary hypothesis is that the combination of the two extracts produces a more potent antidiabetic effect through synergistic action on metabolic, antioxidant, inflammatory, and pancreatic cell regeneration pathways. This study aims to review the current scientific evidence regarding the antidiabetic activity of Dayak Onion and Halalang, identify their multi-target mechanisms of action, and explore their potential synergy in improving insulin sensitivity.

METHOD

This research is a narrative literature review conducted to collect and analyze the results of previous studies on the effects of *Eleutherine palmifolia* and *Imperata cylindrica* on insulin sensitivity. Data sources were obtained through a search of scientific articles in



several electronic databases, such as PubMed, ScienceDirect, Google Scholar, and ResearchGate, with a publication period of 2013–2025.

Keywords used included "*Eleutherine palmifolia*," "*Imperata cylindrica*," "*insulin sensitivity*," "*antidiabetic*," "*oxidative stress*," and "*glucose metabolism*." Articles meeting the inclusion criteria were experimental or observational studies, either in vitro, in vivo, or in silico, that examined one or both of these plants in the context of glucose metabolism or insulin resistance. Articles were written in Indonesian or English and are available in full text.

RESULT AND DISCUSSION

Effects of Eleutherine palmifolia on Insulin Sensitivity

Ethanol extract of *Eleutherine palmifolia* has been shown to significantly lower blood glucose levels and increase plasma insulin levels in streptozotocin-induced diabetic rats, particularly at a dose of 500 mg/kg body weight. This activity suggests that Dayak Onion has the potential to improve metabolic disorders typical of type 2 diabetes, namely insulin resistance and pancreatic β -cell dysfunction. Proposed mechanisms of action include improving pancreatic β -cell function and regeneration, increasing peripheral tissue sensitivity to insulin, and inhibiting the activity of the α -glucosidase enzyme, which plays a role in slowing glucose absorption in the small intestine. In this way, Dayak Onion extract not only plays a role in lowering blood glucose levels but also improves overall glucose homeostasis—two strategic aspects in controlling type 2 diabetes (Yaturramadhan, Dalimunthe and Widyawati, 2019; Kumalasari *et al.*, 2020; Hairani *et al.*, 2023)

Furthermore, bioactive compounds such as eleutherinoside A, eleutherol, and flavonoids play a crucial role in antidiabetic activity by exhibiting antioxidant and anti-inflammatory effects (Kamarudin *et al.*, 2021) These compounds have been shown to inhibit oxidative stress and free radicals, which are among the causes of insulin resistance and pancreatic β -cell damage (Clemente-Suárez *et al.*, 2025) Consequently, the high antioxidant activity of Dayak Onion leads to increased insulin sensitivity, stable glucose homeostasis, and prevention of type 2 diabetes progression (presented in Table 1).

Imperata cylindrica on Insulin Sensitivity

Imperata cylindrica is an herbal plant commonly used for various therapeutic purposes, including controlling blood sugar levels. Its main ingredients include flavonoids, phenolic compounds, and tannins, which are known to have strong antioxidant properties (Sulistyowati and Aziz, 2022a) Several studies have shown that Halalang extract can lower blood sugar levels in laboratory animals with diabetes, which is related to its ability to reduce oxidative stress and improve the body's glucose utilization (Pratiko Gustomi and Kurnijasanti, 2018). In type 2 diabetes mellitus (DM), oxidative stress and chronic, less severe inflammation play a significant role in reducing the body's sensitivity to insulin (Pratiko Gustomi and Kurnijasanti, 2018) The antioxidant and anti-inflammatory

properties of Halalang help inhibit fat breakdown, increase the activity of antioxidant enzymes within the body, and improve mitochondrial function, which indirectly improves glucose utilization by body tissues (presented in Table 1). Although data specifically examining the effect of Halalang on insulin sensitivity measures such as HOMA-IR is limited, its potential for treating diabetes is promising. Possible mechanisms of action include improving cellular redox balance, increasing glucose transport, and reducing insulin resistance due to inflammation. Therefore, Halalang has the potential to be a supportive agent in the treatment of type 2 diabetes, particularly in improving metabolic conditions through antioxidant, anti-inflammatory, and improved glucose utilization (Hairani *et al.*, 2023)

Critical Analysis of Previous Research

Based on the results of numerous studies, the efficacy of Dayak Onion in lowering blood sugar and increasing insulin sensitivity has been proven to be quite stable in experimental animals, particularly rats with diabetes due to streptozotocin injections (Lolok, Rahmat and Wijayanti, 2019). However, most of the research is still in animal or cell trials, so evidence from human trials is still lacking ((Febrinda AE *et al.*, 2016; Deng *et al.*, 2019; Supomo *et al.*, 2019). Furthermore, differences in the type of extract used (ethanol, water, or ethyl acetate), plant part (bulb, leaf, or stem), and dosage and duration of administration make direct comparisons of results between studies difficult (Harlita, - and Asnani, 2018)

For Halalang, there is less data, and much of it is still in the early stages of exploration. Although there are signs of blood sugar-lowering and antioxidant activity (Tremblay *et al.*, 2011), research specifically assessing their effects on insulin sensitivity is still very rare. Differences in experimental animal conditions, the method of inducing diabetes, and the form of the drug can also influence the reported results (presented in Table 1).

These findings reveal a significant research gap: the lack of research evaluating the combination of Dayak Onion and Halalang (Shallot) in terms of their collaboration in treating diabetes. This combination has the potential to provide additional or even enhanced collaborative effects, particularly through antioxidant, anti-inflammatory, and insulin sensitivity enhancement. Therefore, further research testing the combined effects of the two in animal models or human trials is crucial to demonstrate their potential efficacy and safety as an adjunct treatment for diabetes (Xu *et al.*, 2022; Clemente-Suárez *et al.*, 2025)

Multi-Target Mechanisms and Potential Synergy

Both Dayak Onion and Halalang have demonstrated potential in treating diabetes through different but complementary mechanisms. Dayak Onion works by increasing insulin production, protecting pancreatic β -cells, inhibiting the enzyme α -glucosidase, and increasing insulin sensitivity in body tissues (Febrinda AE *et al.*, 2016; Arwati1 *et al.*, 2018; Yaturramadhan, Dalimunthe and Widyawati, 2019). Meanwhile, Halalang plays a more significant role in reducing oxidative stress, inhibiting inflammation, and indirectly improving the body's glucose utilization by enhancing cellular antioxidant status (Unuofin and Lebelo, 2020b). Addressing these multiple issues is crucial in treating diabetes today, which requires a comprehensive approach to multiple disease processes.



Combining these two plants may create a more potent effect, with Dayak Onion helping to better release and respond to insulin, while Halalang protects cells and fights damage. This teamwork can help maintain optimal blood sugar control while preventing long-term problems caused by damage to the body. However, no studies have proven whether the Dayak Onion and Halalang mixture actually improves insulin sensitivity. Therefore, further research on this plant combination is needed to prove its effectiveness and safety as an adjunct treatment for diabetes.

Table 1: Comparison Table Of The Effects Of Dayak Onion And Halalang On Insulin Sensitivity In Diabetes Models

Plant	Blood Glucose Effects	Insulin Effects	Main Mechanism
Dayak Onion (<i>E. Palmifolia</i>) (Hirani et al., 2023; Yaturramadhan et al., 2019)	Significant decrease	Increased/increased sensitivity	β -cell regeneration, α -glucosidase inhibition, antioxidant
Halalang (<i>I. cylindrica</i>) (Sulistiyowati and Aziz, 2022b)	Decrease	Limited data	Antioxidant, anti-oxidative stress

The table above shows that *Eleutherine palmifolia* has a stronger ability to lower blood glucose levels and increase insulin sensitivity than *Imperata cylindrica*, which plays a more significant role through its antioxidant effects. The combination of the two has the potential to provide complementary effects in diabetes management. However, further research is needed to demonstrate this synergistic effect, particularly through combination trials in animal models or clinical studies.

CONCLUSION

Dayak onion has the potential to increase insulin sensitivity through a multi-target mechanism, while *Imperata cylindrica* plays a more active role in suppressing oxidative stress, contributing to improved glucose metabolism. The combination of the two could be a promising local herbal candidate for diabetes support therapy. These findings open up opportunities for further research to test the combination of Dayak onion and Halalang extracts in vivo and to assess their toxicity. Furthermore, exploring their effects on molecular pathways such as GLUT4, AMPK, and insulin gene expression could clarify their synergistic mechanisms.

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