Bioluminescent: Journal of Biology and Life Science
Volume 1, Number 1, June 2026
https://doi.org/10.37253/bio.v1i1.12265

Functional Potential of Indonesian Tuberous Plants in Diabetes Mellitus Management: A Review

Wardatul Aini[1*], Fajri Ramadhan Marviano[2], Azizul Berlyansah[1], Witri Winanda[1], Mona Fathia[1], Khoirul Anwar[1], Ramadani Fitra[1] and Nayla Angelina Laia[1]

[1]Biology Study Program, Faculty of Health and Science, Universitas Internasional Batam, Baloi-Sei Ladi, Jl. Gajah Mada, Tiban Indah, Sekupang District, Batam City 29426, Riau Archipelago, Indonesia.
[2] Biology Education Program, STKIP Ahlussunnah Bukittinggi, Bukittinggi City, West Sumatra 26117, Indonesia.
***Corresponding author**: wardatul.aini@uib.ac.id

Submitted: 25 May 2026; **Final Revision**: 26 June 2026; **Accepted**: 29 June 2026

ABSTRACT

Diabetes mellitus is a major metabolic disorder characterized by chronic hyperglycemia and remains a significant global health challenge. Tuber plants are rich in bioactive compounds and have attracted increasing attention as potential natural antidiabetic agents. This review aimed to summarize the antidiabetic potential of tuber plants and the mechanisms of action of their bioactive compounds based on recent scientific evidence. A literature review was conducted by searching articles published between 2016 and 2026 in Google Scholar, PubMed, and other relevant scientific databases using the keywords tuber plants, diabetes mellitus, antidiabetic activity, and phytochemicals. Original research articles and review papers discussing the antidiabetic effects of tuber plants were included, while studies unrelated to diabetes or lacking sufficient scientific evidence were excluded. The reviewed studies indicate that tuber plants contain bioactive compounds, including flavonoids, tannins, terpenoids, alkaloids, and scopoletin, which exhibit antidiabetic effects through multiple mechanisms, such as enhancing insulin secretion, improving insulin sensitivity, inhibiting carbohydrate-digesting enzymes, reducing oxidative stress, and protecting pancreatic β-cells. These findings suggest that tuber plants have promising potential as complementary natural agents for diabetes mellitus management. However, further clinical studies are required to confirm their efficacy and safety in humans.

Keywords: *antidiabetic, diabetes mellitus, secondary metabolites, tubers*

1. INTRODUCTION

Indonesia is a country located on the equator or equator line. Therefore, Indonesia has abundant natural resources with fertile soil conditions, and it is easy to plant any plants. Indonesia's tropical climate supports the existence of flora in Indonesia to grow with various types that support the survival of other living things, including humans (Firdaus et al., 2022). Plants from Indonesian nature have a variety of potentials to support the welfare of life, one of which is as a traditional food ingredient that has a high potential to be developed as functional food but has not been maximally utilized. Functional food is food that contains high nutritional content and provides health benefits due to the active content contained in the food (Andrias et al., 2019; Hati et al., 2025).

In Indonesia, the dominant staple food consumed by the community is rice. However, the price of rice is quite high, with information obtained that family expenditure on the rice commodity is quite large with details of low-income family expenditure 70% is used for food, and 34% is allocated to buy rice as a staple food (Hanisah et al., 2022). Carbohydrates are the basic needs of the Indonesian people, with most of the population utilizing rice as the main source of carbohydrates. At the same time, there are still many other sources of carbohydrates besides rice that can provide carbohydrates as staple foods such as tubers, nuts, food crops such as sago and breadfruit (multipurpose tree species) that can support national food security (Hasanah et al. 2014). This can be caused by the unfamiliarity of knowledge and information received by the community on the potential of tubers and others in supporting food security and other potentials in realizing people's welfare. Tubers are plants often found and used as food crops with high carbohydrates. In addition to food potential, tubers also have various medical potentials due to the phytochemical content contained therein (Rinaldo, 2022).

Along with the times, the human lifestyle is also increasingly problematic regarding food. People tend to want everything in their lives quickly and instantly. This also happens regarding food, where humans tend to consume fast food. Fast food can cause triglyceride retention in adipose tissue, increasing body weight (obesity) (Nelson et al, 2017). In addition, fast food consumption based on research conducted by (Dominguez et al., 2014) that it is known that there is an influence between the consumption of fast food and soft drinks on the incidence of gestational diabetes with a large risk that routine consumption of these types of foods and drinks is 2.13 times more at risk of suffering from diabetes mellitus. According to research by Kumar et al. (2023) when the body cannot produce enough insulin, it will cause the accumulation of sugar (glucose) levels to increase in the blood and have high consequences on the kidneys. Insufficient insulin resistance and high levels of sugar entering through food intake through food and food affect glucose transporters in the kidneys. Consumption of canned drinks (soft drinks) causes an increase in blood sugar levels. It increases the risk of type 2 diabetes mellitus, which can also be triggered by a family history of type 2 diabetes mellitus (Torres-Ibarra et al., 2020).

Based on food problems and people's lifestyles, that are far from healthy habits. This needs special attention, one of which is by disseminating information on alternative foods

 https://doi.org/10.37253/bio.v1i1.12265

other than rice in maintaining food security and providing information on the medical potential of foods found in Indonesia where this article will discuss "The potential of tubers found in Indonesia as functional and medical foods and their relationship with hormone-immune regulation against diabetes mellitus" due to unhealthy dietary changes. The purpose of preparing this review article is to provide information related to the potential of tubers found in Indonesia in supporting food security and information on the medical effects as a guardian of the body's condition from unhealthy lifestyle habits.

2. MATERIALS AND METHODS

This review article was conducted using a literature review approach by systematically collecting, evaluating, and analyzing relevant scientific publications related to Indonesian tuberous plants, functional foods, hormone–immune regulation, secondary metabolites, antidiabetic activity, and diabetes mellitus. Literature sources were obtained from several electronic databases, including Google Scholar, PubMed, ScienceDirect, and SCIRP. The reviewed articles were limited to publications published between 2016 and 2026 to ensure the inclusion of recent, relevant, and up-to-date findings. The selected literature consisted of original research articles, review articles, and scientific reports that specifically discussed the therapeutic potential of Indonesian tuberous plants in the management of diabetes mellitus through hormonal, immunological, and metabolic mechanisms. Inclusion criteria comprised studies investigating bioactive compounds, antioxidant activity, immunomodulatory effects, gut microbiota modulation, or glucose metabolism associated with Indonesian tuberous plants. Articles lacking full-text access, duplicate publications, or studies not directly related to the research topic were excluded from the review process.

3. RESULTS AND DISCUSSION

3.1 Diabetes Mellitus

Diabetes mellitus is a metabolic disease characterized by chronic hyperglycemia, a long-term increase in blood sugar levels, and metabolic disorders, especially carbohydrates in the body, caused by abnormalities in insulin secretion, insulin action or both (Schuster & Duvuuri, 2002; Ningrum *et al*., 2017). Diabetes mellitus is divided into two main types: type 1 diabetes mellitus and type 2 diabetes mellitus. Type 1 diabetes mellitus is a disease characterized by pancreatic β-cell damage, while type 2 diabetes mellitus is characterized by dysfunctional pancreatic β-cells and insulin resistance (Aguayo-Mazzucato and Bonner-Weir, 2018)

3.2 Hormone Regulation as Blood Sugar Level Regulator

3.2.1 Insulin Hormone

Insulin is a hormone that plays an important role in regulating glucose metabolism in the body produced by beta cells of the pancreas gland. Under normal circumstances, when beta cells are stimulated, insulin is synthesized and then secreted into the blood as needed by the body for blood glucose regulation (Fu et al., 2013; Hasanah, 2013).

Insulin secretion is the process of insulin production involving the microfilament microtubule system in beta cells in the islets of Langerhans that requires energy. Some intermediates also help the release of insulin. It is known that there are several stages in the process of insulin secretion after stimulation by glucose molecules. The first stage is the *glucose* passing through the cell membrane with the help of glucose *transporter* (GLUT), an amino acid compound found in various cells that plays a role in transporting glucose to enter the body tissues in the process of glucose metabolism. Glucose transporter 2 (GLUT2) found in beta cells, for example, is needed in the glucose entry from the blood through the membrane into the cell. In this process, glucose molecules will undergo the process of glycolysis and phosphorylation in the cell and then liberate ATP molecules (Hasanah, 2013).

The hormone insulin plays a role in the regulation of the formation of glucose content in the blood. A lack of insulin hormone will cause high blood glucose levels (hyperglycemia), and excess insulin can cause glucose levels too low (hypoglycemia) (Hasanah, 2013).

3.2.2 Glucagon Hormone

Glucagon is a hormone released from the alpha cells of the islets of Langerhans in the pancreas when blood glucose levels drop. Glucagon plays an important role in glucose homeostasis in the body through glycogenolysis (breakdown of liver glycogen) and gluconeogenesis (formation of glucose from fat and protein). In diabetics, there is inappropriate glucagon secretion, and glucagon fails to restore blood sugar levels to normal limits, resulting in severe hypoglycemia (Wendt & Eliasson, 2022).

3.3 Tuber Plants with Potential as Anti-diabetes

Based on **Table 1**, it is known that tubers found in Indonesia have the potential to protect against diabetes. This potential is due to the content of soluble fiber, polysaccharides and secondary metabolite compounds such as flavonoids, saponins, tannins, terpenoids, scopoletin and others that act as antidiabetics. Flavonoid compounds regulate the activity of enzymes involved in the metabolic process of carbohydrates and neutralize free radicals that allow damage to pancreatic β-cells that play a role in insulin secretion. In addition, the antidiabetic properties of flavonoids are also shown by activating the cAMP signal cascade, which increases insulin secretion ability. Therefore, flavonoids can improve pancreatic β-cell function and help stimulate insulin secretion to reduce the risk of diabetes (Babu et al. 2013; Ghorbani et al., 2019)

In addition, terpenoid content in tubers can also act as an antidiabetic by acting as an insulin sensitizer that increases glucose uptake and stimulates the performance of pancreatic β-cells in secreting insulin (Ardalani et al. 2021; Song et al., 2022). In contrast, the scopoletin content contained in root crops can activate AMPK, a pathway that mediates glucose uptake. Activation of AMPK can stimulate GLUT4 translocation to the cell surface and increase glucose absorption (Jang *et al.,* 2019).

3.4 Mechanisms of Action of Bioactive Compounds in Tuber Plants as Antidiabetic Agents

The antidiabetic potential of tuber plants is attributed to various bioactive compounds, including flavonoids, tannins, terpenoids, alkaloids, saponins, polysaccharides, and scopoletin. These compounds exert hypoglycemic effects through different but complementary mechanisms that contribute to glucose homeostasis and pancreatic β-cell protection.

3.4.1 Flavonoids

Flavonoids are the most widely reported phytochemicals in tuber plants with antidiabetic activity. They regulate carbohydrate metabolism by inhibiting α-amylase and α-glucosidase, thereby delaying carbohydrate digestion and reducing postprandial blood glucose levels. Flavonoids also stimulate insulin secretion through activation of the cyclic adenosine monophosphate (cAMP) signaling pathway and improve insulin sensitivity by activating the PI3K/Akt signaling pathway, which promotes GLUT4 translocation and glucose uptake in skeletal muscle and adipose tissue. Furthermore, their antioxidant properties reduce oxidative stress and protect pancreatic β-cells from damage caused by reactive oxygen species (Proença et al., 2021).

Table 1. Tuber candidates with potential as antidiabetics

Plant Name (Tuber)	Ingredients/Compounds involved	Mechanism of Action	References
Uwi banggai (*Dioscorea alata* L.)	Flavonoids, Triterpenoid saponins, Tannins, Steroids, Alkaloids, Terpenoids	Regulates the activity of carbohydrate metabolism enzymes, is an antioxidant, improves the function of β-pancreatic cells, stimulates insulin secretion, increases glucose absorption, acts as an insulin sensitizer, stimulates insulin production, regenerates damaged β-pancreatic cells, and improves glucose tolerance.	Khaerati et al., 2020; Makiyah et al., 2022
Suweg tubers (*Amorphophallus campanulatus*)	Dietary fiber and water-soluble polysaccharides	Supports the body's homeostasis process, regulating carbohydrate and lipid metabolism	Lianah et al., 2018
White Bulbs (*Colocasia esculenta* L. Schott)	Water soluble polysaccharides, dioscerin, diosgenin	Acts as an antioxidant, hydrolyzes complex carbohydrates, maintains and repairs pancreatic β-cell damage	Raharjo, 2018
Bidara upas (*Merremia mammosa*)	Flavonoids	Accelerates healing of hyperglycemia	Wulandari et al., 2021
Cassava (*Manihot esculenta*) and Sweet Potato (*Ipomoea batatas*)	Scopoletin, anthocyanins	Activating PI3K and AMPK signaling pathways and improving insulin sensitivity in 3T3-L1 cells, lowering blood sugar, inhibiting free radical production, increasing insulin secretion, and preventing insulin resistance	Jang et al., 2019
Bulbs of Elephant Foot Sweet Potato (*Amorphophallus paeoniifolius*)	Steroids, flavonoids, alkaloids, sterols, terpenoids,	pancreatic β-cell regeneration	Rahman et al., 2021
Kuzdu root (*Pueraria montana*)	Isoflavones	stimulates pancreatic β-cell regeneration	Duru et al., 2020
Satoimo tubers (*Colocasia esculenta* var. Antiquorum)	Carbohydrates	It helps provide sufficient energy for the body and reduces blood sugar elevation.	Sukmawati, 2022
Arrowroot tuber (*Marantha arundinaceae* L)	Water Soluble Polysaccharides	Increased viscosity in the gastrointestinal tract, slowing gastric emptying and inhibiting glucose absorption, accelerating glucose absorption.	Yuniastuti et al., 2018
Talas Mentawai (*Colocasia esculenta* L var Mentawai)	Flavonoid	Antidiabetic effects by improving insulin sensitivity, regulating glucose and lipid metabolism, reducing oxidative stress and inflammation, and protecting pancreatic β-cells	Santoso et al., 2024; Santoso et al., 2025; Aini et al., 2024

3.4.2 Tannins

Tannins contribute to glycemic control by inhibiting digestive enzymes involved in carbohydrate hydrolysis, particularly α-amylase and α-glucosidase. This inhibition slows glucose absorption in the intestine and suppresses postprandial hyperglycemia. In addition, tannins exhibit antioxidant and anti-inflammatory activities that help preserve pancreatic β-cell integrity and reduce oxidative damage associated with chronic hyperglycemia (Correa, et al., 2023).

3.4.3 Terpenoids

Terpenoids improve glucose metabolism primarily by enhancing insulin sensitivity. Several studies have demonstrated that terpenoids activate AMP-activated protein kinase (AMPK) and peroxisome proliferator-activated receptor gamma (PPAR-γ), leading to increased glucose uptake, suppression of hepatic gluconeogenesis, and improved lipid metabolism. Some terpenoids also stimulate pancreatic β-cell function, resulting in increased insulin secretion and better glycemic control (Rampengan et al., 2025).

3.4.4 Alkaloids

Alkaloids exhibit antidiabetic effects through multiple mechanisms, including stimulation of insulin secretion, enhancement of insulin receptor signaling, inhibition of intestinal glucose absorption, and modulation of enzymes involved in carbohydrate metabolism. Their antioxidant activity also contributes to the protection of pancreatic β-cells from oxidative injury, thereby preserving endogenous insulin production (Tiong et al., 2013).

3.4.5 Scopoletin

Scopoletin, a coumarin derivative identified in cassava and several medicinal plants, has demonstrated significant antidiabetic activity. It activates the AMPK signaling pathway, which enhances GLUT4 translocation to the plasma membrane and increases glucose uptake by peripheral tissues. Scopoletin also reduces oxidative stress and inflammatory responses, improves insulin sensitivity, and protects pancreatic β-cells against oxidative damage, thereby contributing to improved glucose homeostasis (Park & Han, 2023).

3.4.6 Polysaccharides and Dietary Fiber

Water-soluble polysaccharides and dietary fiber present in several tuber plants improve glycemic control by increasing gastrointestinal viscosity, delaying gastric emptying, and slowing intestinal glucose absorption. These mechanisms reduce postprandial blood glucose spikes and improve insulin responsiveness. In addition, polysaccharides have been reported to modulate gut microbiota and improve metabolic homeostasis, further supporting their antidiabetic effects (Ganesan & Xu, 2019).

Overall, the antidiabetic activity of tuber plants results from the synergistic effects of these bioactive compounds. Their combined actions include enhancement of insulin secretion, improvement of insulin sensitivity, inhibition of carbohydrate-digesting enzymes, reduction of oxidative stress and inflammation, stimulation of glucose uptake through GLUT4 translocation, and protection of pancreatic β-cells. These mechanisms support the potential application of tuber plants as complementary natural agents for the prevention and management of diabetes mellitus.

4. CONCLUSION

The rich variety of tubers plant indigenous to Indonesia, including sweet potatoes (*Ipomoea batatas*), Uwi banggai (*Dioscorea alata* L.), Suweg tubers (*Amorphophallus campanulatus*), White Bentul tubers (*Colocasia esculenta* L. Schott), Bidara upas (*Merremia mammosa*), Kimpul tubers (*Xanthosoma violaceum* Schott.), Cassava (*Manihot esculenta*), Elephant Foot tuber (*Amorphophallus paeoniifolius*) and Kuzdu root (*Pueraria montana*) have potential as antidiabetics through β-pancreatic cell protection activity, stimulating β-pancreatic cell regeneration and increasing insulin secretion caused by soluble fiber content and secondary metabolite compounds such as flavonoids, saponins, tannins, terpenoids, scopoletin, steroids, sterols, isoflavones and alkaloids.

ACKNOWLEDGEMENTS

Acknowledgements should be placed before the references and may include individuals, institutions, funding bodies, or other parties who contributed to the research or manuscript preparation.

REFERENCES

Aguayo-Mazzucato, C., & Bonner-Weir, S. (2018) Pancreatic Beta Cell Regeneration as A Possible Therapy for Diabetes. *Cell Metabolism*, 27, 57–67.

Aini, W., Santoso, P., & Rahayu, R. (2024). Mentawai Taro Corm Flour's Benefits on Hyperglycemia and Pancreas Histopathology in Diabetic Mice. *Jurnal Biologi Tropis*, 24 (4): 934 – 943.

Andrias, D. R., Fahmida, U., & Adi, A. C. (2019). Nutritional potential of underutilized food crops to improve diet quality of young children in food insecure prone areas of Madura Island, Indonesia. *Asia Pac J Clin Nutr*, 28(4), 826-836.

Ardalani, H., Hejazi Amiri, F., Hadipanah, A., Kongstad, K. T. (2021). Potential Antidiabetic Phytochemicals in Plant Roots: A Review of In Vivo Studies. *J Diabetes Metab Disord*, 20(2), 1837-1854.

Babu, P. V., Liu, D., Gilbert, E. R. (2013). Recent Advances in Understanding the Anti-Diabetic Actions of Dietary Flavonoids. *J Nutr Biochem*, 24(11), 1777-1789.

Correa, V. G., Garcia-Manieri, J. A. A., Silva, A. R., Backes, E., Corrêa, R. C. G., Barros, L., Bracht, A. &Peralta, R. M. (2023). Exploring The α-Amylase-Inhibitory Properties of Tannin-Rich Extracts of Cytinus Hypocistis on Starch Digestion. *Food Research International*, 173, 113260.

Dominguez, L. J., Martínez-González, M. A., Basterra-Gortari, F. J., Gea, A., Barbagallo, M., & Bes-Rastrollo, M. (2014). Fast food consumption and gestational diabetes incidence in the SUN project. *PLoS ONE*, 9(9).

Duru, K. C., Mukhlyna, E. A., Moroz, G. A. Gette, I. F., Ganilova I. G., & Kovaleva, E. G. (2020). Antidiabetic Effect of Isoflavone Rich Kudzu Root Extract in Experimentally Induced Diabetic Rats. *Journal of Functional Foods*, 68, 103922.

Firdaus, N., Supriatna, Supriatna, J. (2022). Ecosystem services research trends in Indonesia: a bibliometric analysis. *Biodiversitas*, 23 (2), 1105-1117.

Fu, Z., Gilbert, E. R., & Liu, D. (2013). Regulation of insulin synthesis and secretion and pancreatic Beta-cell dysfunction in diabetes. *Curr Diabetes Rev*, 9(1), 25-53.

Ganesan, K., & Xu, B. (2019). Anti-Diabetic Effects and Mechanisms of Dietary Polysaccharides. *Molecules (Basel, Switzerland)*, *24*(14), 2556.

Ghorbani, A, Rashidi, R, Shafiee-Nick, R. (2019). Flavonoids for Preserving Pancreatic Beta Cell Survival and Function: A Mechanistic Review. *Biomed Pharmacother*, 111, 947-957.

Hanisah, H., Anzitha, S., Ningsih, F. L., & Mastuti, R. (2022). Analysis of The Relationship of Income with The Proportion of Household Food Expenditure of Rice Farms in Gampong Alue Merbau, Langsa City, *Agrisocionomics: Jurnal Sosial Ekonomi Pertanian*, 6(1), 201-209.

Hasanah, U., Hadi, E. P., & Hidayah, H. A. (2014). Keanekaragaman dan Pemanfaatan Ubi-Ubian sebagai Alternatif Tanaman Pangan di Kecamatan Bantarkawung Kabupaten Brebes. *Biosfera,* 31(2), 62-70.

Hati, E. P., Rum, F. F., & Febrianti, N. (2025). Potential of Local Functional Foods for Food Security in Indonesia: A Narrative Review. *Journal of FoodSecure Indonesia*, 1(1), 50–65.

Jang, J. H., Park, J. E., & Han, J. S. (2019). Scopoletin increases glucose uptake by activating PI3K and AMPK signaling pathways and improves insulin sensitivity in 3T3-L1 cells. *Nutr Res*, 74, 52-61.

Khaerati, K., Amini, D., & Ihwan, I. (2020). Aktivitas Antidiabetes Ekstrak Air-Etanol, n-Heksan, dan Etil Asetat Uwi Banggai (*Dioscorea alata* L.) Dengan Metode Induksi Aloksan Pada Mencit Jantan (Mus musculus). *Galenika Journal of Pharmacy*, 6(2), 243-252.

Kumar, M., Dev, S., Khalid, M. U., Siddenthi, S. M., Noman, M., John, C., Akubuiro, C., Haider, A., Rani, R., Kashif, M., Varrassi, G., Khatri, M., Kumar, S., & Mohamad, T. (2023). The Bidirectional Link Between Diabetes and Kidney Disease: Mechanisms and Management, *Cureus*, 15(9), e45615.

Lianah, Tyas, D. A., Armanda, D. T., & Setyawati, S. M. (2018). Aplikasi Umbi Suweg (*Amorphophallus campanulatus*) sebagai Alternatif Penurun Gula Darah pada Penderita Diabetes Mellitus. *Journal of Biology and Applied Biology*, 1(1), 1-12.

Makiyah, S. N. N., Kita, M., Setyawati,I., & Tasminatun, S. (2022). *Dioscorea alata* L. Tubers Improve Diabetes through Anti-hyperglycemia. *Indones Biomed J*, 14(4), 365-375.

Nelson, D., Cox, M. M., & Lehninger, A. L. (2017). Lehninger Principles of Biochemistry. 7th ed. New York: W.H. Freeman, 2387.

Ningrum, L. P., Salim, N., & Balqis, U. (2017). Pengaruh Ekstrak Daun Jamblang (*Syzygium cumini* L.) terhadap Histopatologi Hepar Tikus Putih (*Rattus norvegicus*) Diabetes Melitus. *JIMVET*, 01(4), 695-701.

Park, J. E., & Han, J. S. (2023). Scopoletin Protects INS-1 Pancreatic β Cells from Glucotoxicity by Reducing Oxidative Stress and Apoptosis. *Toxicology in-vitro: an international journal published in association with BIBRA*, *93*, 105665.

Proença, C., Ribeiro, D., Freitas, M., & Fernandes, E. (2022). Flavonoids as Potential Agents in The Management of Type 2 Diabetes Through The Modulation of α-amylase and α-glucosidase Activity: A Review. *Critical Reviews in Food Science and Nutrition*, *62*(12), 3137–3207.

Raharjo, S. J. (2018). Aktivitas Polisakarida Larut Air Umbi Bentul (*Colocasia esculenta* (L.) Schot) Sebagai Kandidat Agen Antidiabet. *Indonesian Chemistry and Application Journal*, 2(1), 1-6.

Rahman, S. S., Salaudin, H. M., Rahman, M. Muhsin, M. M., & Rouf, S. M. (2021). Nutritional Composition and Antidiabetic Effect of Germinated Endosperm (*Borassus flabellifer*), Tuber (*Amorphophallus paeoniifolius*) and Their Combined Impact on Rats, *Biochemistry and Biophysics Reports*, (25), 100917.

Rampengan, D. D. C. H., Lele, J. A. J. M. N., Romano, R., Taslim, N. A., Tjandrawinata, R. R., Santini, A., & Nurkolis, F. (2025). Harnessing The Power of Marine Terpenoids Against Diabetes-Associated Oxidative Stress. *Frontiers in nutrition*, *12*, 1651804.

Rinaldo, D. (2020). Carbohydrate and Bioactive Compounds Composition of Starchy Tropical Fruits and Tubers, in Relation to Pre and Postharvest Conditions: A review. *Journal of Food Science*, 85, 249-259.

Santoso, P., Rahayu, R., Ilyas, S., Aini, W., & Dhiah Hirwanto, S. (2025). Fiber and Starch of *Colocasia esculenta* var. Mentawai Ameliorate Adiposity, Dyslipidemia and Gut Dysbiosis in Mice Fed High Fat Diet. *Journal of Research in Pharmacy*, 29(1), 310-321.

Santoso, P., Ilyas, S., Rahayu, R., Aini, W., Hirwanto, S. D. (2024). Mentawai Taro (*Colocasia esculenta* var. Mentawai) Corm Flour Ameliorates Insulin Resistance and Leukocytosis Promoted by High-Fat Diet in Mice. *Intl J Agric Biol*, 32, 409–416.

Schuster, D. P., Duvuuri, V. (2002). Diabetes mellitus. *Clin Podiatr Med Surg*, 19(1), 79-107.

Song, B. R., Alam, M. B., Lee, S. H. (2022). Terpenoid-Rich Extract of Dillenia indica L. Bark

Displays Antidiabetic Action in Insulin-Resistant C2C12 Cells and STZ-Induced Diabetic Mice by Attenuation of Oxidative Stress. *Antioxidants (Basel)*, 11(7), 1227.

Torres-Ibarra, L., Rivera-Paredez, B., Hernández-López, R., Canto-Osorio, F., Sánchez-Romero, L. M., López-Olmedo, N., and Barrientos-Gutiérrez, T. (2020). Regular consumption of soft drinks is associated with type 2 diabetes incidence in Mexican adults: findings from a prospective cohort study. *Nutrition Journal*, 19, 126.

Wendt, A. & Eliasson, L. (2022). Pancreatic Alpha Cells and Glucagon Secretion: Novel Functions and Targets in Glucose Homeostasis. *Current Opinion in Pharmacology*, 63, 102199.

Wulandari, A. & Soleha, S. (2021). Pharmacological, Activities of *Merremia Mammosa. Jurnal Info Kesehatan*, 11(1), 394-399.