

Indigenous Indonesian herbal plant and personalized treatments for diabetic retinopathy: A bibliometric analysis

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Abstract. Diabetic retinopathy (DR) affects the retinal blood vessels due to prolonged hyperglycemia. The number of patients diagnosed with diabetic retinopathy is predicted to increase every year. Personalized medicine is needed to conquer this unique disease due to the distinction in severity and progression. Utilizing herbs can be a new strategy for the treatment of diabetic retinopathy. A bibliometric and visual analysis was conducted to promote a comprehensive knowledge map of plants for diabetic retinopathy. Moreover, this study can serve as a helpful starting point for future studies on the use of indigenous Indonesian herbal plants as personalized treatments for diabetic retinopathy. Studies on diabetic retinopathy were extracted from the Scopus database using the keywords “plant” AND “diabetic retinopathy.” Data analysis was conducted using Scopus tools and VOSviewer version 16.20 for visualization. Bibliometric data elucidate the relationship between the keywords ‘plant’ and ‘diabetic retinopathy’ and show several mechanisms of plants in the treatment of diabetic retinopathy. These results confirm the great potential of indigenous Indonesian herbal plants in personalized treatment for diabetic retinopathy and provide guidance for further research on this topic.

1 Introduction

The International Diabetes Federation (IDF) data showed that 536.6 million people worldwide were suffering from diabetes in 2021, with this quantity projected to reach 700 million by 2045 [1]. One of the most serious and abundant complications of diabetes is diabetic retinopathy (DR), a condition affecting the retinal blood vessels due to prolonged hyperglycemia. Globally, the number of people with diabetic retinopathy is assumed to rise from 103.12 million in 2020 to 160.5 million by 2045, with approximately 44.82 million individuals at risk of vision impairment [2].

This disease is classified as a malignant ocular complication that can lead to loss of vision and eye obstruction [3]. There are two phases of diabetic retinopathy: the initial phase, non-

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proliferative diabetic retinopathy (NPDR), predisposes retinal cells, and proliferative diabetic retinopathy (PDR), leading to blindness [4]. This progression provokes the financial load on healthcare systems, especially as the disease advances from early to severe stages [5].

The treatment of diabetic retinopathy commonly includes vitrectomy, intraocular administration of anti-VEGF antibodies, and retinal photocoagulation, each presenting distinct challenges and potential complications [6,7]. Photocoagulation using a laser procedure can result in various ocular complications, including breakdown of the visual field and loss of visual acuity. On the other hand, the repeated administration of anti-VEGF antibodies may increase the risk of endophthalmitis [7]. Thus, personalized medicine is required to overcome this disease due to the severity and progression on the disease varying among individuals. Personalized medicine for diabetic retinopathy treatment has to concern minimizing side effects [8].

Herbal applications have emerged as a promising complementary method for controlling diabetic retinopathy. Researchers have found that various plant constituents and medicinal plants can be used to treat the disease. Phytochemicals, such as flavonoids, have been reported to protect against blood-retinal barrier disruption, enhance antioxidant status, suppress the release of pro-inflammatory mediators, and preserve retinal thickness by reducing neurodegeneration and apoptosis. Herbal utilization is considered an effective therapeutic option despite the limited concentration and bioavailability of these compounds in meals, notably when local delivery systems are employed. The effectiveness of this therapy has been demonstrated both alone and in combination for treatment or prevention [7,9].

Further comprehensive investigation of the use of herbal treatments on individuals with diabetic retinopathy is required to explore the development of this treatment. Bibliometric analysis is a helpful method for identifying research trends and mapping potential future topics [10]. This statistical approach is used to evaluate scientific literature and its citation patterns over time [3]. This method helps to interpret and map the development and structure of established research areas by systematically processing large amounts of unstructured data [11]. Bibliometric studies on diabetic retinopathy, such as hyperlipidemia and lipid-lowering therapy, have been conducted [12]. Another bibliometric study on diabetic retinopathy using stem cells has been done [13], while a notable absence is found in such studies regarding the use of herbal therapy for diabetic retinopathy. Therefore, we conducted this study using bibliometric tools to analyze herbal plants as a treatment for diabetic retinopathy.

This investigation presents background information and relevant research on the numerous plant-based studies examining diabetic retinopathy. We will cover included keywords or co-occurrence, global publication trends, countries, institutions, authors, citation weight, contributing papers, sources, and journals. In addition, this study can serve as an advantageous starting point for further studies on indigenous Indonesian herbal plants and personalized treatment for diabetic retinopathy.

2 Methodology

2.1 Data resource strategy

Studies on diabetic retinopathy were extracted from the Scopus database using the keywords “plant” AND “diabetic retinopathy.” All research published between 1967 and 2025 was included in this study. The database searching was conducted on June 10, 2025. There was no need for ethical approval because neither human subjects nor animal models were used in this investigation.

Inclusion criteria: All research related to the keywords, with a focus on Indonesian herbal plants, regardless of the geographic origin.

Exclusion criteria: Records with “undefined author” were excluded due to incomplete author information.

2.2 Data analysis

Data analysis was conducted using Scopus tools to examine the research trends based on year of publication, growth patterns, author contributions, affiliations, countries, document types, and subject areas. All bibliographic information was used for descriptive analysis. For additional analysis and visualization, VOSviewer version 1.6.20 software was utilized [14]. VOSviewer facilitated a visual analysis of co-occurrence patterns, where terms are represented as nodes of varying sizes reflecting their frequency of occurrence. Terms that frequently appear together are positioned closer to each other, leading to the formation of text clusters [6]. The overall methodology is summarized in Figure 1.

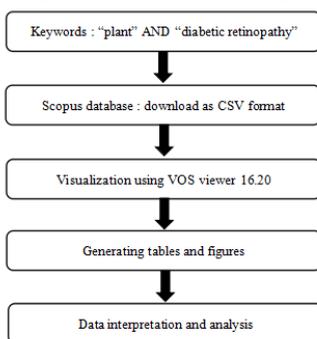


Fig. 1. Flow diagram of the method

3 Results and discussion

3.1 Analysis of worldwide publication trends

Publications about plants and diabetic retinopathy have been around since 1967, starting with an article titled “Diffrairel 100 in the treatment of retinal vascular disorders and high myopia.” The pattern of the yearly quantity of publications from 1967 to 2025 is shown in Figure 2, which has the highest quantity of publications ever noted in 2023, totaling 60 papers. An increase in publications is observed from 2002 to 2025. The highest increase occurred from 2001 to 2002, with a 66.67% rise, followed by a 37.25% increase from 2011 to 2012 and a 26.67% increase from 2009 to 2010. From 2020 to 2024, the number of publications was more than 35 per year.

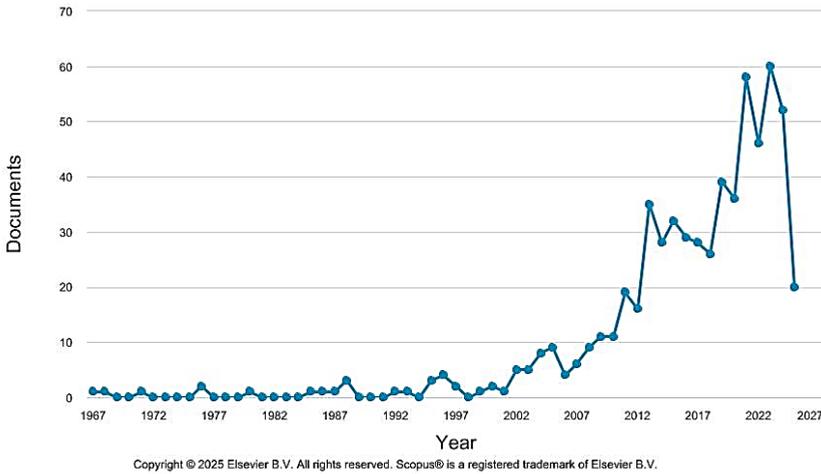


Fig. 2. Publication trends in the field of plant and diabetic retinopathy according to the quantity of annual publications

By mid-2025, the number of publications has reached 20 papers, indicating that research on plants and diabetic retinopathy is receiving growing attention. The rising incidence of diabetic retinopathy and the potential of plants as a treatment option have inspired researchers to explore further. Some of the Indonesian herbal plants that can be used as treatments for diabetic retinopathy include sweet potato, which can be used to treat hyperglycemia that can cause *diabetic retinopathy*, *Curcuma longa*, and *Emblca officinalis*, which contains curcumin and β -glucogallin, and *Moringa oleifera* [15–17].

3.2 Analysis of the contributing countries

A total of 69 countries across Asia, America, and Europe have contributed to publications related to plants and diabetic retinopathy. The top ten countries with the most publications are shown in Figure 3. China leads with 175 papers, followed by India with 129 papers, and the United States with 69 papers. Traditional Chinese medicine, which extensively uses herbs and acupuncture, likely drives China’s interest in this field [18]. Chinese researchers often explore native herbs, some of which also grow well in Indonesia, including blueberries, ginger, *Manihot esculenta* (cassava), *Belmoschus manihot*, and *Curcuma wenyujin* [19–22].

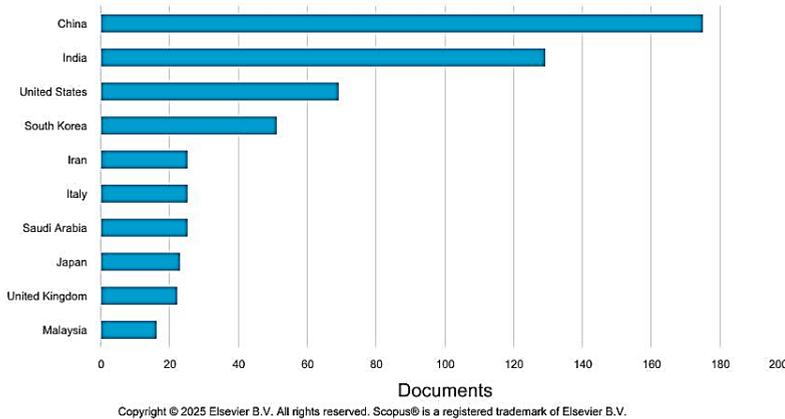


Fig. 3. Top 10 countries in the field of plant and diabetic retinopathy research worldwide

3.3 Analysis of contributing institution

There are 619 publications related to plants and diabetic retinopathy from 160 institutions worldwide. Korea Institute of Oriental Medicine leads with 24 publications, followed by Chengdu University of Traditional Chinese Medicine with 17 publications and the Ministry of Education of the People's Republic of China with 15 publications. The Korea Institute of Oriental Medicine, as the institution with the most publications, promotes the slogan “From tradition to the future, Korean medicine leads the world”. Indonesia also has traditional plants that have health benefits, especially for the specific treatment of patients with diabetic retinopathy, such as *secang* bark extract and *dewandaru* leaf extract, which can act as antiangiogenic agents [23,24].

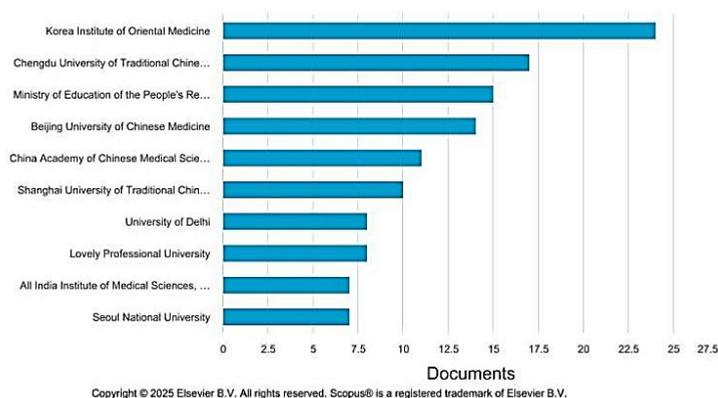
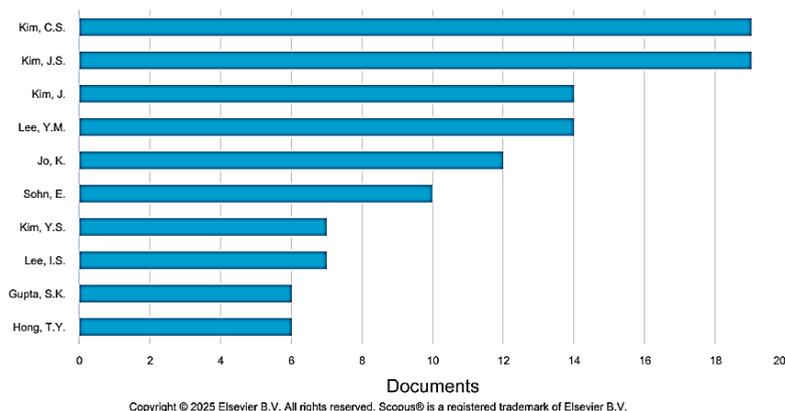


Fig 4. Top 10 institutions with the highest productivity publications about plant and diabetic retinopathy

3.4 Analysis of the contributing authors

Publications from 1967 to 2025 were written by 160 authors from all over the world. The top 10 authors are presented in Figure 5. The top author with the most publications is Kim, C.S., and Kim J.S. from the Korea Institute of Oriental Medicine, with 19 publications between 2009 and 2024. Notably, Kim C.S. identified a new phytochemical component, a biphenyl glycoside from *Osteomeles schwerinae* called OSSC1E-K19, that can stop retinal vascular damage brought on by glycated albumin [25]. Besides biphenyl glycoside, *Osteomeles schwerinae* also contains 5'-methoxy-biphenyl-3,4,3'-triol, which acts against diabetic retinopathy pathogenesis via anti-VEGF mechanisms and the hexosamine pathway. Similar compounds with VEGF signaling-related mechanisms can be found in Indonesian natural products such as *Moringa oleifera*, *Morus alba*, and *Andrographis paniculata* Nees [26].



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Fig. 5. Top 10 contributing authors in the field of plant and diabetic retinopathy research worldwide, together with the number of their published papers

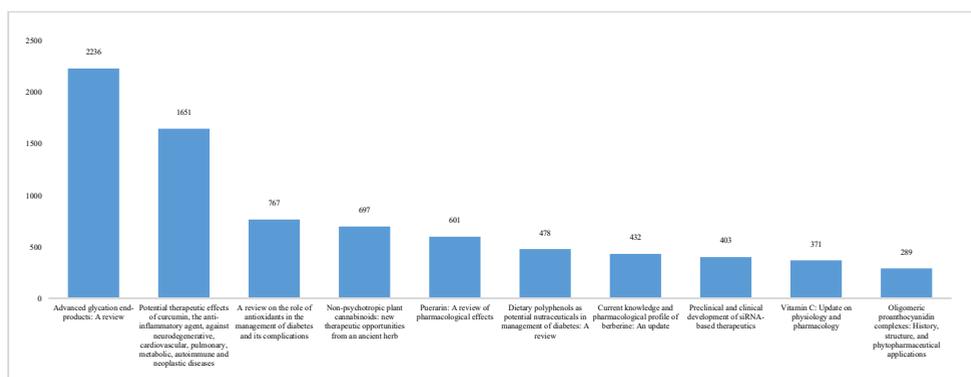


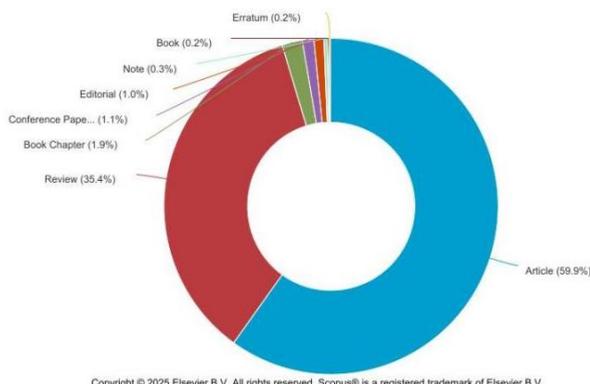
Fig. 6. Top 10 most valuable publication by citation weight

In addition to authors with the highest number of documents, an analysis was also conducted on publications with the highest number of citations, as shown in Figure 6. The publication with the most citations was the paper titled “Advanced glycation end-products: A review”, written by Singh et al. in 2001, which was published in *Diabetologia*, with 2,234 citations. This is followed by Aggarwal et al. with the publication title “Potential therapeutic effects of curcumin, the anti-inflammatory agent, against neurodegenerative, cardiovascular, pulmonary, metabolic, autoimmune and neoplastic diseases” in 2009, which is published in the *International Journal of Biochemistry and Cell Biology* with 1,647 citations. The third was a publication by Rahimi et al. with the title “Potential therapeutic effects of curcumin, the anti-inflammatory agent, against neurodegenerative, cardiovascular, pulmonary, metabolic, autoimmune, and neoplastic diseases” in 2005, published in *Biomedicine and Pharmacotherapy*, which has garnered 767 citations. Singh et al. in their paper addressed the theme of the potential effects of curcumin, a phytochemical compound widely found in Indonesia. Curcumin has been proven to be effective in the prevention and treatment of diabetic retinopathy [27]. This can serve as a basis for utilizing curcumin from indigenous Indonesian plants to prevent and treat diabetic retinopathy.

3.5 Analysis of contributing papers and sources

Since 1967, there have been 619 publications related to plants and diabetic retinopathy. The distribution of publication types is presented in Figure 7. Article-based publications explore

more about the secondary metabolites produced by natural remedies for diabetes retinopathy. Highly cited articles discuss the phenolic content in plants for the prevention of diabetes mellitus complications, one of which is diabetic retinopathy. Phenolic compounds are commonly found in native Indonesian plants, so exploring native Indonesian plants for the treatment of diabetic retinopathy has great potential.



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Fig. 7. Types of documents that published in plant and diabetic retinopathy

The top 10 sources of publications related to plants and diabetic retinopathy are presented in Table 1. Publications in the Journal of Ethnopharmacology mostly contain information related to the pharmacological effects of plants on diabetic retinopathy. Some of the mechanisms that emerge include tonifying the kidneys, activating blood circulation, and regulating anti-inflammatory and anti-angiogenic pathways [22,28].

Table 1. The most productive source about plant and diabetic retinopathy

Source	Documents	Citations
Journal of Ethnopharmacology	21	671
Nutrients	19	728
Biomedicine and Pharmacotherapy	15	1152
Frontiers in Pharmacology	14	163
Evidence-based complementary and Alternative Medicine	12	351
Phytomedicine	12	474
Phytotherapy Research	12	993
Molecules	10	267
International Journal of Molecular Sciences	8	97
Current Medical Chemistry	7	523

3.6 Analysis of keyword co-occurrence

A network visualization of the plant and diabetic retinopathy publication co-occurrence map using VOSviewer is presented in Figure 8. The keyword 'diabetic retinopathy' appeared 172 times, with a total strength of 257 and 60 links. The keyword 'plant' was found in the phrase 'medicinal plants' with 12 occurrences and a total link strength of 27. Additionally, the keywords 'herbal medicines', 'traditional herbal medicine', and 'natural products' were found, all of which refer to plants. The top three clusters with the highest occurrence frequency are Cluster 1, Cluster 2, and Cluster 3. In Cluster 1, the most frequent keywords are diabetic retinopathy (172), diabetes mellitus (41), and retina (15). In Cluster 2, the most frequent keywords are oxidative stress (58), antioxidant (26), and antioxidants (19). In Cluster 3, the most frequent keywords are apoptosis (22), aldose reductase (17), and vascular endothelial growth factor (15). The overlay visualization of the plant for diabetic retinopathy

4 Conclusion

A bibliometric study conducted using the Scopus database with the keywords “plant” and “diabetic retinopathy” showed that there were 619 publications from 1963 to 2025, with the most publications in 2023. The country with the most documents is China, and the institution with the most documents is the Korea Institute of Oriental Medicine. The most productive authors are Kim and Kim J.S., with 19 publications from 2009 to 2024, and the article with the most citations is titled ‘Advanced Glycation End-Products: A Review’ written by Singh et al. in 2001 in *Diabetologia*, with 2,234 citations. The VOSviewer visualization shows that diabetic retinopathy appears 172 times with a total strength of 257 and 60 links, while medicinal plants appear 12 times with a total strength of 27 and 15 links. Medicinal plants and diabetic retinopathy have a direct relationship. Some of the mechanisms used for the treatment of diabetic retinopathy include tonifying the kidneys, activating blood circulation, and regulating anti-inflammatory and anti-angiogenic pathways. Personalized treatment in diabetic retinopathy refers to the principles of precision medicine and utilizes the power of molecular profiling and biomarker-driven strategies. By understanding individual conditions, we can customize personalized treatment in accordance with the mechanisms of plant treatment that have been published in the findings of this paper.

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