

Bibliometric Analysis of Medicinal Plants Research for Diabetes Mellitus in Indonesia

Khoerul Anwar^{1,2}, Nanang Fakhruddin³, Retno Murwanti⁴, Agung Endro Nugroho^{4*}

¹Doctoral Program in Pharmaceutical Sciences, Faculty of Pharmacy, Universitas Gadjah Mada, Yogyakarta, Indonesia

²Pharmacy Department, Faculty of Mathematics and Natural Sciences, Universitas Lambung Mangkurat, Banjarbaru, South Kalimantan, Indonesia

³Department of Pharmaceutical Biology, Faculty of Pharmacy, Universitas Gadjah Mada, Yogyakarta, Indonesia

⁴Department of Pharmacology and Clinical Pharmacy, Faculty of Pharmacy, Universitas Gadjah Mada, Yogyakarta, Indonesia

Email: nugroho_ae@ugm.ac.id

ABSTRAK

Diabetes mellitus (DM) memiliki hubungan yang erat dengan perubahan pola makan dan gaya hidup yang tidak sehat. Jumlah penderita diabetes di Indonesia terus meningkat. Minat masyarakat dalam mengonsumsi tanaman obat semakin berkembang karena pasien lebih memilih produk alami yang dianggap lebih aman. Penelitian tentang tanaman obat sebagai agen antidiabetes juga menunjukkan tren yang meningkat. Studi ini bertujuan untuk memetakan penelitian yang menggunakan tanaman obat terkait diabetes di Indonesia. Data subjek penelitian diperoleh dari Scopus, dan perangkat lunak statistik RStudio dengan paket bibliometric digunakan untuk menganalisis dan memvisualisasikan data. Hasil analisis menunjukkan bahwa pertumbuhan publikasi di bidang ini mencapai 36,25% per tahun. Jumlah penulis bersama per dokumen adalah 4,93 dengan tingkat kolaborasi internasional sebesar 15,12%. Sebanyak 1.548 artikel dengan 4.877 penulis diterbitkan di 429 jurnal dan prosiding terpilih. Elya B (n = 35), Universitas Airlangga (n = 435), dan IOP Conference Series: Earth and Environmental Science (n = 92) merupakan penulis, afiliasi, dan penerbit paling produktif. Dengan jumlah sitasi per artikel sebesar 7,78 menunjukkan bahwa penelitian dari Indonesia berkontribusi pada penelitian lain. Penulis artikel di Indonesia sebagian besar (89,73%) berkolaborasi dengan peneliti sesama di Indonesia, sementara sisanya (10,27%) berkolaborasi dengan peneliti di luar negeri seperti Jepang, Malaysia, Thailand, China, dan Korea. Dapat disimpulkan bahwa kuantitas dan kualitas penelitian tentang tanaman obat untuk DM di Indonesia semakin meningkat dan berkontribusi pada penelitian lebih lanjut untuk pengelolaan diabetes.

Kata Kunci: *Bibliometric, Diabetes Mellitus, Tumbuhan Obat, Scopus, Rstudio*

ABSTRACT

Diabetes mellitus (DM) strongly associated with changes in unhealthy diet and lifestyles. The number of diabetic patients in Indonesia continues to increase. Public interest in consuming medicinal plants was developing because patients prefer on natural products and are considered safer. Research on medicinal plants as antidiabetic agents also shows an increasing trend. This study aims to map research using medicinal plants related to diabetes in Indonesia. Data on research subjects were retrieved from Scopus and the bibliometric package in RStudio statistical software was used to analyze and visualize the data. The results of the analysis showed that the growth of publications in this field was 36.25% per year. The number of co-authors per document was 4.93 with an international co-authorship rate of 15.12%. A total of 1548 articles with 4877 authors were published in 429 selected journals and proceedings. Elya B (n = 35), Universitas Airlangga (n = 435), the IOP Conference Series: Earth and Environmental Science (n = 92) was the most productive author, affiliation, and publisher. With the number of citations per article of 7.78, it shows that this research from Indonesia contributes to another research. The authors of the articles in Indonesia mostly (89.73%) collaborated with fellow researchers in Indonesia, while the rest (10.27%) collaborated with researchers abroad such as Japan, Malaysia, Thailand, China, and Korea. It can be concluded that the quantity and quality of research on medicinal plants for DM in Indonesia is increasing and contributing to further research for diabetes management.

Keywords: *Bibliometric, Diabetes Mellitus, Medicinal Plants, Scopus, Rstudio*

I. INTRODUCTION

Diabetes Mellitus is a chronic condition characterized by increased blood glucose levels deficiency or reduced insulin sensitivity or both (Hardt & Ewald, 2011). DM is a progressive chronic disease characterized by the body's inability to metabolize carbohydrates, fats, and proteins (Banday et al., 2020). The number of DM sufferers around the world is continue to rise with high treatment financing (Lovic et al., 2019). Diabetes treatment will be differentiated based on the type of dm suffered by the patient (Butt, 2022).

Indonesia is one of the countries with the largest biodiversity in the world. There is a lot of potential for medicinal

plants that can be developed for therapy in the treatment of diseases. Out of the 30000–40000 plant species in Indonesia, approximately 2500–7500 are known to have medicinal properties (BAPPENAS, 2016; Cahyaningsih et al., 2021). These include native species, introduced species, wild plants, and cultivated ones. One of these medicinal plants is used for the treatment of diabetes mellitus both empirically and scientifically (Hartanti & Budipramana, 2020; Arifah et al., 2022).

In line with this, many studies use medicinal plants in Indonesia for the treatment of diabetes mellitus. *Morinda citrifolia* is known to have antidiabetic activity in streptozotocin-induced mice (Anwar et al.,

2017) and in diabetic patients (Dafriani et al., 2020). *Andrographis paniculata* is also widely studied for its activity as an antidiabetic, either alone or in combination with other medicinal plants (Nugroho et al., 2012; Nugroho et al., 2013; Wediasari et al., 2020; Astuti et al., 2022) and can improve diabetic retinopathy (Hidayat & Wulandari, 2021). In addition, there are still many other medicinal plants whose activities are studied for antidiabetics such as *Curcuma domestica* (Aini et al., 2024; Widowati et al., 2018), *Mangifera indica* (Rahayuningsih et al., 2022), and many other plants.

Although research on the use of medicinal plants for diabetes is widely carried out in Indonesia, no bibliometric report has yet been published on this topic. Bibliometric analysis can be used to determine the trend of research being carried out in a certain time frame (Fitriyah & Dasari, 2023). The number of publications, the productivity of authors, the most productive institutions, the journal publishers that publish the most articles and the most influential articles can be known used bibliometric. This information will be useful to find out how the research on the use of medicinal plants for diabetes in Indonesia is scientific so it will be mapped related to this research in the future (Li et al., 2023).

II. METHODS

A. Methodology of Study Technique

Literature data on the *Mangifera* genus was extracted from the Scopus database. The database was used because Scopus has comprehensive information and has an extensive research database in various disciplines. In addition, Scopus is also very popular among researchers with its easy navigation (Moral-muñoz et al. 2020). The search in the Scopus database used the keyword ("diabetes AND mellitus" OR antidiabetic OR diabetic OR hypoglycemic) AND (herbal OR plant OR herbs OR leaf OR fruit OR seed OR bark OR root OR extract OR fraction OR isolate) in the search engine "Article Title, Abstract, Keywords". The search commands for this study were restricted as follows: year of publication (2006-2024), document type (Article OR Conference paper), and language (English only).

B. Data Extraction and Analysis

All search result information from the Scopus database was exported in CSV format. Data extraction, tabulation, and network visualization using RStudio (2025.09.2 Build 418) with bibliometric software installed. The bibliometric analysis in this publication used Biblioshiny for Bibliometrics. The data analyzed includes publication trends, contributing countries,

contributing institutions, contributing publishers, authors and their networks, analysis of the most influential papers and their citations, and keywords.

III. RESULTS AND DISCUSSION

A. Main Information

In this study, we mapped the trends related to medicinal plant research for diabetes in Indonesia. Based on our literature search using the Scopus database, we obtained 1548 english-language research articles (Table I). The articles used in this study

were published in 429 sources by 4877 authors. Scopus is one of the most wide-ranging databases and is therefore widely used for bibliometric analysis (Meho & Yang, 2006; Caputo & Kargina, 2022). The average age of the documents used in this study was 4.44 years using 12476 references. There were only 19 documents with a single author, and the average co-authors per document was 4.93 with international co-authorship of 15.12%.

Table I. Main Information of Medicinal Plants Research for Diabetes Mellitus in Indonesia from 2006 to 2024

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	2006:2024
Sources (Journals, Books, etc)	429
Documents	1548
Annual Growth Rate %	36.25
Document Average Age	4.44
Average citations per doc	7.782
References	12476
DOCUMENT CONTENTS	
Keywords Plus (ID)	6705
Author's Keywords (DE)	3254
AUTHORS	
Authors	4877
Authors of single-authored docs	19
AUTHORS COLLABORATION	
Single-authored docs	20
Co-Authors per Doc	4.93
International co-authorships %	15.12
DOCUMENT TYPES	
article	1252
conference paper	296

B. Global Publication Trend

The trend of the average number of publications and citations per publication

per year is presented in Figure 1. Since the first of publications was observed in 2006,

there has been a significant increase in research output per year until now (annual growth rate 36.25%). Only 105 (6.78%) of the 1548 research articles were published between 2006-2015, while the remaining 1443 (93.22%) articles were published from 2016 to 2024. Even in the last 4 years (2021-2024), 895 (57.82%) articles related to medicinal plant research for diabetes mellitus were published. Since the pandemic which shows that patients with COVID-19 have a greater prevalence of hyperglycemia encourages research on diabetes, especially from medicinal plants (Rizvi et al., 2022). Several natural antidiabetic products show promising therapeutic potential for the treatment of COVID-19 (Yusuf et al., 2022).

C. Relevant Author

Information on the most productive authors conducting research on diabetes from medicinal plants in Indonesia between 2006 and 2024 was retrieved from Scopus. A total of 4877 authors with 1548 articles were used for this most prolific author analysis. Each document was written by 4.93 people on average, indicating collaboration between the authors to conduct the research, although there were 19 articles written by a single author.

The 6 most prolific authors identified were Elya B (n=33, h-index 10, 373 total citations, and start publication in 2011),

Hanafi M (n=24, h-index 6, 122 total citations, and start publication in 2007), Nugroho AE (n=23, h-index 9, 379 total citations, and start publication in 2011), An-sori ANM (n = 21, h-index 11, 408 total citations, and start publication in 2017), Winarni D (n = 21, h-index 11, 388 total citations, and start publication in 2017), and Ramadhan R (n = 21, h-index 7, 141 total citations, and start publication in 2015).

The number of publications of each author does not depend on when he started publication. As the most productive author, Elya B started her productivity in 2011 or 14 years ago with an average of 2.5 documents per year. While Hanafi M started 18 years ago and Nugroho AE started 14 years ago with an average of 1.5 and 1.9 documents per year respectively. The data of top 20 authors of medicinal plants research for diabetes mellitus in Indonesia from 2006 to 2024 presented on Table II. This information is very useful for researchers to plan and discuss the significance of the study findings and design collaborations (Swastini et al., 2023).

The H-index, which is measured by a combination of the number of publications and the number of citations, has become the main measure of the impact of the published scientific work of an author or group of authors in an institution (Koltun & Hafner, 2021). The number of published articles does not correlate with h-index if the

number of citations does not follow. In this study, the 5 most productive authors do not all have a high h-index. Hanafi M (h-index 7) and Ramadhan R (h-index 8) are authors with high productivity but low citations so that the h-index is also not high. The year

of publication does not correlate with the number of citations. Hanafi M who started publication in 2007 had the lowest number of citations (187 citations) among the top 5 authors.

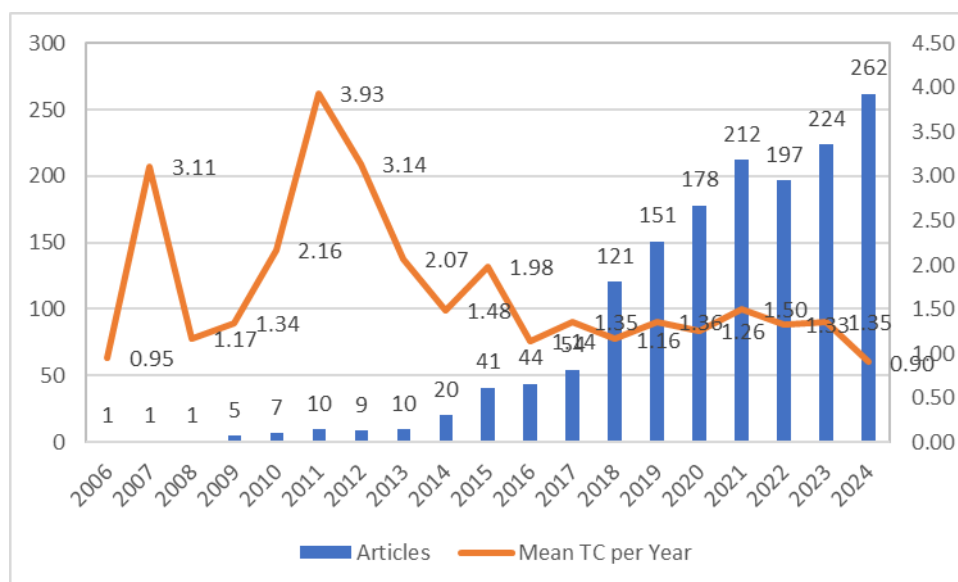


Figure 1. Annual Scientific Production of Medicinal Plants Research for Diabetes Mellitus in Indonesia from 2006 to 2024

Table II. Top 20 Authors of Medicinal Plants Research for Diabetes Mellitus in Indonesia from 2006 to 2024

Author	Number of Publications	h_index	g_index	m_index	Total Citation	Articles Fractionalized	Start of Publication
Elya B	35	10	21	0.667	494	8.40	2011
Hanafi M	27	7	12	0.368	187	5.34	2007
Nugroho AE	26	10	21	0.667	462	6.23	2011
Ansori ANM	25	12	22	1.333	499	3.66	2017
Ramadhan R	23	8	13	0.727	192	4.26	2015
Winarni D	21	12	21	1.333	460	2.91	2017
Husen SA	20	12	20	1.333	442	2.75	2017
Irawan C	18	4	9	0.5	92	2.98	2018
Susilo RJK	17	12	17	1.333	412	2.30	2017
Widowati W	17	8	14	0.727	198	1.98	2015
Hayaza S	16	10	16	1.429	364	2.11	2019
Widyawati T	16	8	15	0.727	249	3.22	2015
Ilyas S	16	7	9	0.636	113	3.60	2015
Sukandar EY	15	7	13	0.438	187	3.99	2010
Tjandrawinata RR	15	7	9	0.467	112	3.82	2011
Artanti N	15	6	11	0.4	127	2.86	2011

Author	Number of Publications	h_index	g_index	m_index	Total Citation	Articles Fractionalized	Start of Publication
Wresdiyati T	15	5	9	0.313	101	3.58	2010
Phuwapraisirisan P	14	7	12	0.636	158	2.72	2015
Safitri A	14	6	11	0.75	133	3.44	2018
Fajriah S	14	5	6	0.556	56	2.36	2017

D. Relevant Affiliations

Publications regarding research on medicinal plants for diabetes in Indonesia are carried out by the best institutions in the country, both educational and research institutions (Figure 2). The top 5 highest publication was done by Universitas Airlangga with 435 articles, followed by Universitas Indonesia (n = 340), Universitas Brawijaya (n = 328), Universitas Gadjah Mada (n =

279), and Universitas Sumatera Utara (n = 238). Among the 20 institutions with the highest publications, 19 of them are universities, and only 1 research institute, Research Center for Chemistry BRIN (LIPI), is ranked 17th (n = 73). The average number of co-authors per article is 5.62, indicating that one article can be written by more than one different affiliation.

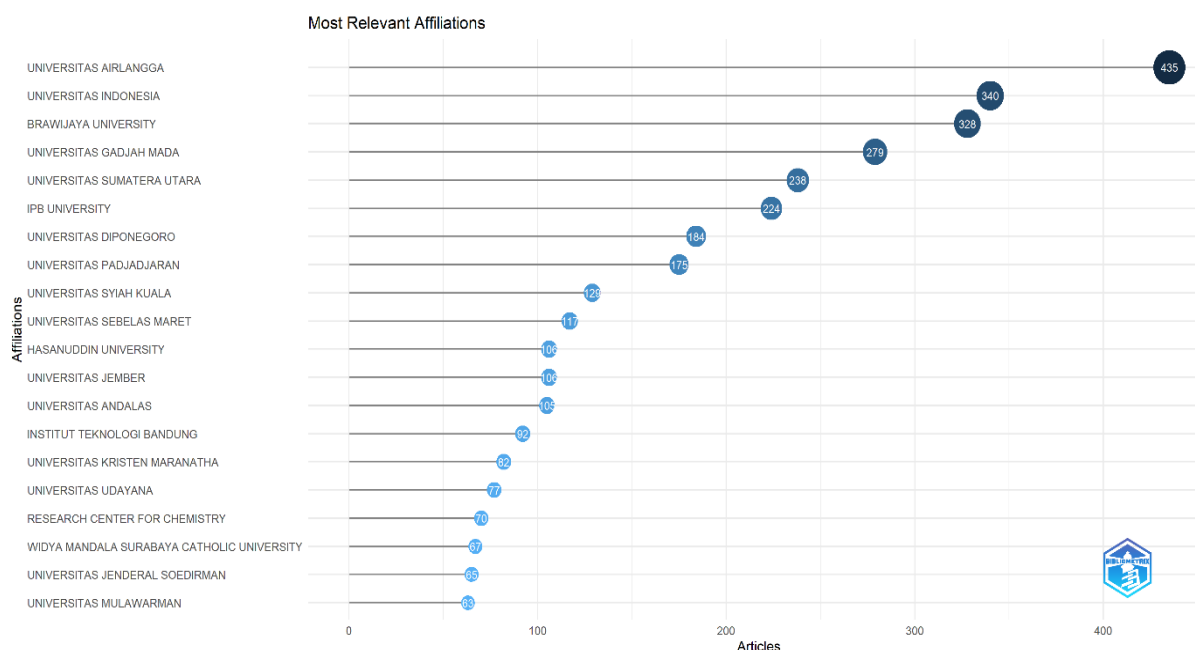


Figure 2. Affiliation of Medicinal Plants Research for Diabetes Mellitus in Indonesia from 2006 to 2024 Article

E. Relevant Journals

In this study, there were 1548 documents in 429 journals contained in the Scopus

database. The 5 most active journals in publishing manuscripts on antidiabetic research from medicinal plants are IOP Conference Series: Earth and Environmental Science (n =

92, total citations 338, h-index 10, and started publication 2017), followed by AIP Conference Proceedings (n = 84, total citations 177, h-index 6, and started publication 2014), Research Journal of Pharmacy and Technology (n = 58, total citations 314, h-index 8, and started publication 2019), Pharmacognosy Journal (n = 52, total citations 425, h-index 12, and started publication 2017), and Tropical Journal of Natural Product Research (n = 49, total citations 109, h-index 5) (Table III). This list of journals can be a reference for researchers who will submit their research results for publication (Arifah et al., 2022a).

Table III. Top 20 Journal as Source of Medicinal Plants Research for Diabetes Mellitus in Indonesia Publications from 2006 to 2024

Author	Number of Publications	Total Citation	h_index	g_index	m_index	Start of Publication
IOP Conference Series: Earth And Environmental Science	92	338	10	13	1.111	2017
AIP Conference Proceedings	84	177	6	10	0.5	2014
Research Journal of Pharmacy And Technology	58	314	8	15	1.143	2019
Pharmacognosy Journal	52	425	12	16	1.333	2017
Tropical Journal of Natural Product Research	49	109	5	5	0.833	2020
Journal of Physics: Conference Series	39	180	7	11	0.875	2018
Food Research	31	97	5	9	0.556	2017
Journal of Applied Pharmaceutical Science	29	223	9	13	0.75	2014
Open Access Macedonian Journal of Medical Sciences	29	140	7	10	1	2019
Rasayan Journal of Chemistry	29	125	6	9	0.857	2019
Biodiversitas	27	130	7	9	0.7	2016
International Journal of Applied Pharmaceutics	26	53	4	4	0.444	2017
Asian Journal of Pharmaceutical and Clinical Research	25	153	7	11	0.467	2011
IOP Conference Series: Materials Science and Engineering	20	120	5	10	0.556	2017
Molecules	15	342	12	15	1.5	2018
International Food Research Journal	15	254	10	15	0.769	2013
Systematic Reviews in Pharmacy	15	118	6	10	0.857	2019
Biomedical and Pharmacology Journal	15	87	5	8	0.455	2015
Journal of Pharmacy and Pharmacognosy Research	14	69	5	7	0.833	2020
Indonesian Journal of Pharmacy	14	53	5	6	0.5	2016

F. Country Collaboration Research

Figure 3 shows the Map of Medicinal Plant Research Collaboration for Diabetes Mellitus in Indonesia 2006-2024 with other countries in the world. The red lines on the map indicate research collaboration between the countries connected by the lines. Researchers in Indonesia collaborate with other

researchers in China, Japan, Korea, Australia, UK, Saudi Arabia, Germany, France, USA, and many other countries. These research collaborations will be useful in the future for policy dialog and market collaboration in diabetes treatment use medicinal plants (Garg & Garg, 2023).

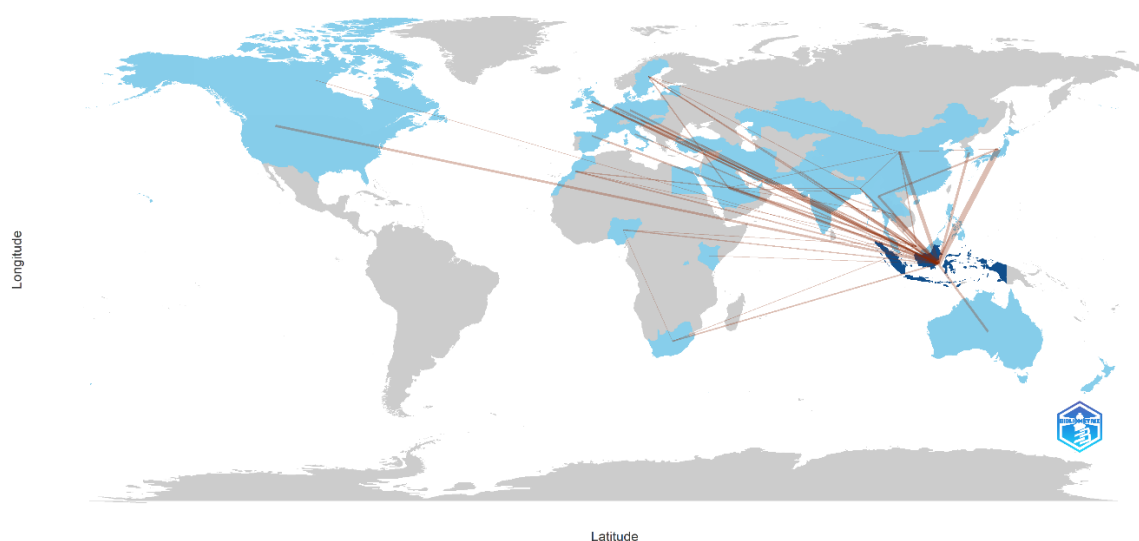


Figure 3. Country Collaboration Map Research of Medicinal Plants Research for Diabetes Mellitus in Indonesia from 2006 to 2024

G. Trend Topics Analysis

The topic trend of antidiabetic research using medicinal plants is illustrated in the figure 4. The first publication on this topic began in 2006. An early trend is research using *Phaleria macrocarpa* as an antidiabetic (Triastuti et al., 2009). Previously, *Phaleria macrocarpa* was widely researched as an anticancer (Faried et al., 2007; Astuti et al., 2007). In vitro antidiabetic research using α -glucosidase inhibitor activity and propolis began in 2014. After that, until 2018, many in vivo antidiabetic

studies were carried out using alloxan and streptozotocin inducers in mice and rats with parameters measured glucose levels, insulin, and blood lipid profiles. In-silico antidiabetic research using molecular docking began to be widely carried out in 2020 in line with the Covid-19 pandemic which caused many research laboratory activities to be stopped. In 2021 research towards GC-MS profiling, antibacterial and dyslipidemia received a lot of attention. *Clitoria ternatae* (telang flower) with its distinctive blue color and widely used for

health drinks in 2023 is starting to receive attention for research. *Clitoria ternatae* has potential for the treatment of DM, through antioxidant and anti-inflammatory activity

in mice with DM and dyslipidemia. Additionally, *Clitoria ternatae* may have the ability to prevent DM problems (Widowati et al., 2023; Dewi et al., 2023).

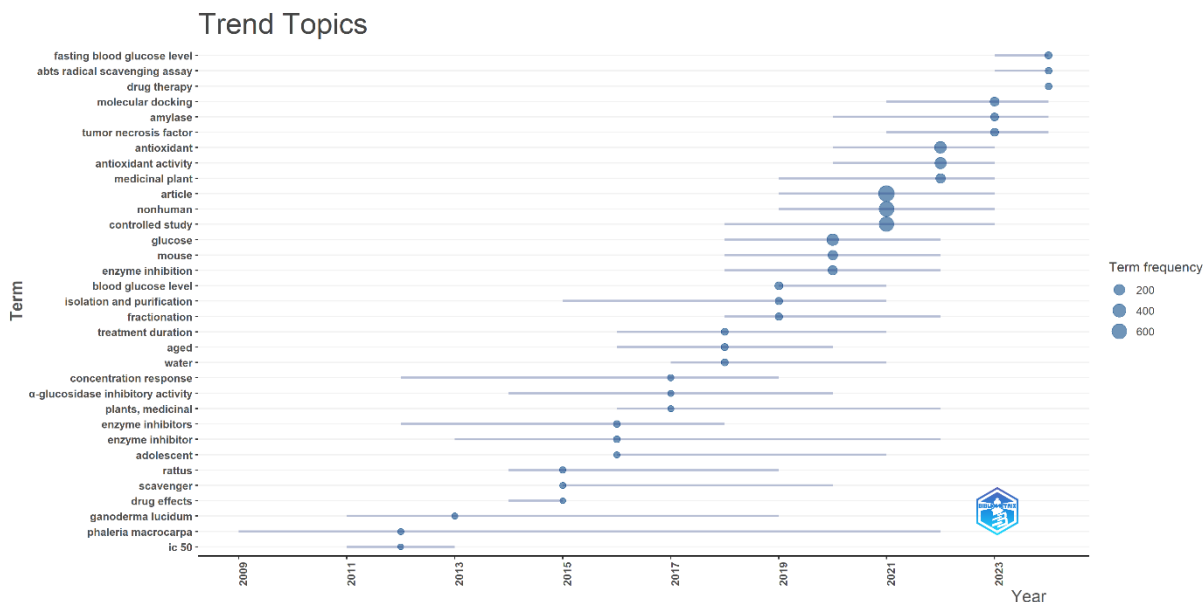


Figure 4. Trend Topic of Medicinal Plants Research for Diabetes Mellitus in Indonesia from 2006 to 2024

H. Most Relevant Words Analysis

The word tree map was generated with the Biblioshiny application using keywords that have a frequency of more than 10. The amount of documents that use keywords can be known so that analysis can be carried out based on the frequency of the most widely used keywords. From the figure 5, diabetes mellitus (n = 210) is the most used keyword, followed by antidiabetic (n = 174), antioxidant (n = 167), diabetes (n = 112), α -glucosidase (n = 65), alloxan (n = 51), blood glucose (n = 47), hyperglycemia (n = 36), molecular docking (n = 34), and oxidative stress (n = 32) are the 10 most keywords.

Analysis with a word tree map can also be used to find out future research maps and forecasts regarding future research problems (Swastini et al., 2023). Additionally, it can also be known the breadth and depth of research in this field that has been carried out. Antidiabetic research using medicinal plants in addition to antidiabetic activities, was also researched related to antioxidant activity, α -glucosidase, the use of alloxan and streptozotocin inducers for in vivo testing in rat test animal models by measuring blood glucose levels, in-silico tests using molecular docking, and stress oxidative measurement.

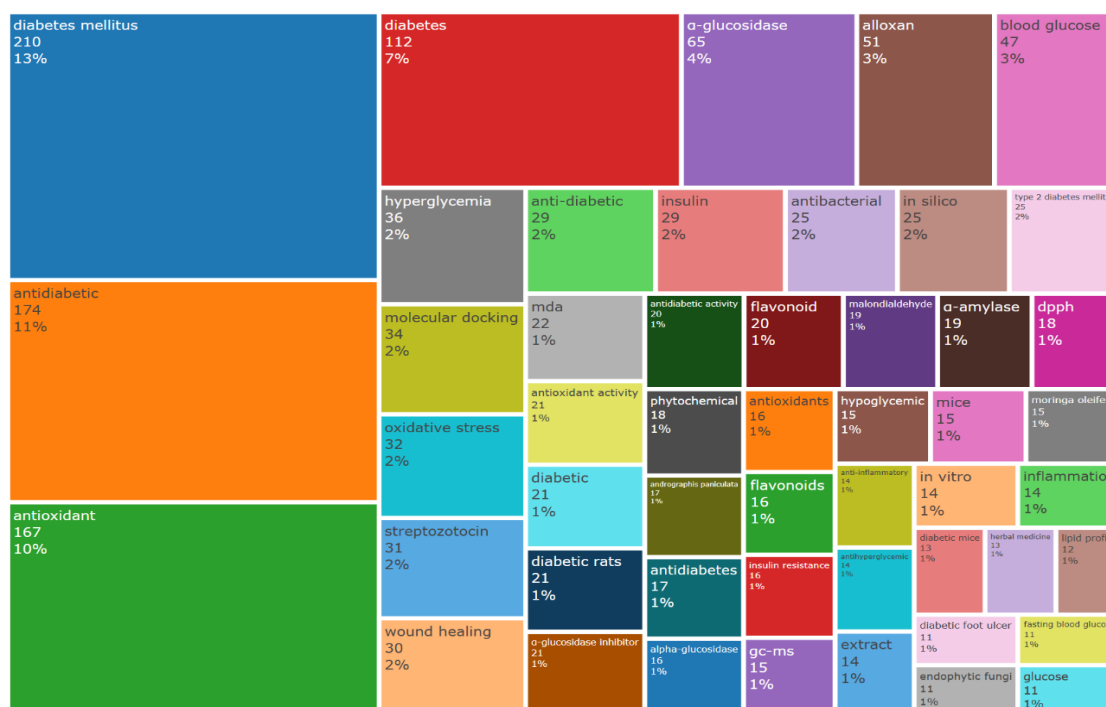


Figure 5. Word Tree Map of Medicinal Plants Research for Diabetes Mellitus in Indonesia from 2006 to 2024

I. The Most Influential Paper

The most influential articles are determined by the total number of citations to the article. The more the article is cited, the greater the impact it will have on other articles. The Table IV shows the 5 articles with the highest number of citations.

The article titled "Curcumin ameliorates macrophage infiltration by inhibiting NF- κ B activation and proinflammatory cytokines in streptozotocin induced-diabetic nephropathy" written by Soetikno et al. in 2011 had the most citations ($n = 207$) with an average of 13.80 citations per year. Streptozotocin-induced diabetic rats were treated with curcumin at 100mg/kg/day orally for 8 weeks. Various inflammatory markers in kidney rats were assessed. This

study showed that curcumin treatment can inhibit development of diabetic neuropathy by reducing macrophage infiltration through the inhibition of NF- κ B activation in rats.

The second influential article was written by Hendra et al. (2011) entitled "Flavonoid analyses and antimicrobial activity of various parts of *Phaleria macrocarpa* (Scheff.) Boerl fruit" with 152 citations (average 10.13 citations per year). *Phaleria macrocarpa* (Scheff.) Boerl empirically used for treating the hypertensive, diabetic, cancer and diuretic patients. The major flavonoids presented in the pericarp of its fruits were kaempferol, myricetin, naringin, and rutin, while in the mesocarp and seed were naringin and quercetin.

Table IV. Top 5 Articles with The Highest Number of Citations

No	Author	Title	Source	Total Citation	TC per Year
1	Soetikno V., Sari F.R., Veeraveedu P.T., Thandavarayan R.A., Harima M., Sukumaran V., Lakshmanan A.P., Suzuki K., Kawachi H., and Watanabe K.	Curcumin ameliorates macrophage infiltration by inhibiting NF-B activation and proinflammatory cytokines in streptozotocin induced-diabetic nephropathy	Nutrition & Metabolism, 2011, 8(35): 1-11	207	13.80
2	Hendra R., Ahmad S., Sukari A., Shukor M.Y., and Oskoueian E.	Flavonoid analyses and antimicrobial activity of various parts of <i>Phaleria macrocarpa</i> (Scheff.) Boerl fruit	International Journal of Molecular Sciences, 2011, 12(6): 3422-3431	152	10.13
3	Fatmawati, S., Shimizu, K. and Kondo, R.	Ganoderol B: a potent α -glucosidase inhibitor isolated from the fruiting body of <i>Ganoderma lucidum</i>	Phytomedicine, 2011, 18(12): 1053-1055.	133	8.87
4	Elya, B., Basah, K., Mun' im, A., Yulastuti, W., Bangun, A. and Septiana, E.K.	Screening of α -glucosidase inhibitory activity from some plants of Apocynaceae, Clusiaceae, Euphorbiaceae, and Rubiaceae	Journal of Biomedicine and Biotechnology, 2012, 281078; 1-6	129	9.21
5	Atanasov, A.G., Wang, J.N., Gu, S.P., Bu, J., Kramer, M.P., Baumgartner, L., Fakhrudin, N., Laddurner, A., Malainer, C., Vuorinen, A. and Noha, S.M.	Honokiol: a non-adipogenic PPAR γ agonist from nature	Biochimica et Biophysica Acta (BBA)-General Subjects, 2013, 1830(10): 4813-4819	127	9.77

An article entitled “Ganoderol B: a potent α -glucosidase inhibitor isolated from the fruiting body of *Ganoderma lucidum*” written by Fatmawati et al. (2011) was the third influential article with 133 citations (average 8.87 citations per year). The neutral fraction of *Ganoderma lucidum* contained an active compound, (3 β ,24E)-

lanosta-7,9(11),24-trien-3,26-diol (ganoderol B). It was found to have high α -glucosidase inhibition and considerable potential as diabetes drug.

The article was written by written by Elya et al. (2012) entitled “Screening of α -glucosidase inhibitory activity from some

plants of Apocynaceae, Clusiaceae, Euphorbiaceae, and Rubiaceae” with 129 citations (average 9.21 citations per year) was the fourth influential article. In vitro diabetes activity of 80% ethanol extracts of leaves and twigs of some plants from the Apocynaceae, Clusiaceae, Euphorbiaceae, and Rubiaceae family was evaluated with α -glucosidase inhibitory activity methods using spectrophotometric methods. Thirty-seven of forty-five samples have better α -glucosidase inhibitors activity than the control acarbose (IC_{50} 117.20 μ g/mL. It shows that medicinal plant has potential for diabetic treatment.

The fifth most influential article was “Honokiol: a non-adipogenic PPAR γ agonist from nature”, written by Atanasov et al. (2013) with 127 citations (average 9.77 citations per year). In silico, honokiol is predicted to bind to the PPAR γ ligand binding pocket as a dimer and act as a partial agonist in PPAR γ -mediated luciferase reporter assays. Honokiol prevents hyperglycemia and suppresses weight gain in diabetic mice by stimulating basal glucose uptake. However, it does not induce adipogenesis.

IV. CONCLUSION

The use of medicinal plants for treatment is increasing over time. Along with that, research on medicinal plants for treatment is also increasing. This study is

the first bibliometric analysis that will provide an overview of research on the use of medicinal plants for diabetes in Indonesia from 2006-2024. A total of 1548 articles were taken from the Scopus database with 4877 authors published in 429 journals and proceedings. Elya B (n = 35), Universitas Airlangga (n = 435), the IOP Conference Series: Earth and Environmental Science (n = 92) was the most productive author, affiliation, and publisher. The growth of publications in this field was 36.25% per year. The number of co-authors per document was 4.93 with an international co-authorship rate of 15.12%. The authors of the articles in Indonesia mostly (89.73%) collaborated with fellow researchers in Indonesia, while the rest (10.27%) collaborated with researchers abroad. With the number of citations per article of 7.78, it shows that this research from Indonesia contributes to another research.

ACKNOWLEDGMENT

This study was funding by the Ministry of Research, Technology, and Higher Education Indonesia under the PPS-PDD Programs with contract number 3084/UN1/DITLIT/Dit-Lit/PT.01.03/2023.

REFERENCES

- Aini ZQ, Wijayanti T, Puspitasari AC (2024) Analisis efektivitas kunyit hitam (*Curcuma caesia* Roxb.) dalam penurunan kadar mikroalbumin dan

- serum kreatinin pada tikus diabetes nefropati. *Jurnal Indonesia Sehat*. 3(2):79–85.
<https://www.jurnal.samodrailmu.org/index.php/jurinse/article/download/214/125>
- Anwar K, Wigati D, Sudarsono, Nugroho AE (2017) Blood glucose reduction of combination of *Andrographis paniculata* (Burm.f.) Nees and *Morinda citrifolia* L. ethanolic extract in neonatal streptozotocin-induced Type 2 diabetes mellitus rats. *International Food Research Journal*. 24(5):2153–2160.
[http://ifrj.upm.edu.my/24%20\(05\)%202017/\(44\).pdf](http://ifrj.upm.edu.my/24%20(05)%202017/(44).pdf)
- Arifah FH, Nugroho AE, Rohman A, Sujarwo W (2022a) A bibliometric analysis of preclinical trials of *Andrographis paniculata* (Burm.f.) Nees in diabetes mellitus. *South African Journal of Botany*. 151:128–143.
<https://doi.org/10.1016/j.sajb.2021.12.011>
- Arifah FH, Nugroho AE, Rohman A, Sujarwo W (2022b) A review of medicinal plants for the treatment of diabetes mellitus: The case of Indonesia. *South African Journal of Botany*. 149:537–558.
<https://doi.org/10.1016/j.sajb.2022.06.042>
- Astuti E, Raharjo TJ, Eviane D (2007) Cytotoxicity of *Phaleria macrocarpa* (Scheff) Boerl fruit flesh and seed extract of ethanol and its effect against p53 and Bcl-2 genes expression of normal cell. *International Conference on Chemical Sciences (ICCS-2007)*. 24–26.
https://www.academia.edu/download/32386534/journal_kesetimbangan_fasa2.pdf
- Astuti NT, Novitasari PR, Tjandrawinata R, Nugroho AE, Pramono S (2022) Anti-diabetic effect of andrographolide from sambiloto herbs (*Andrographis paniculata* (Burm.f.) Nees) through the expression of PPAR γ and GLUT-4 in adipocytes. *Indonesian Journal of Biotechnology*. 27(4):203–211.
<https://doi.org/10.22146/ijbiotech.68800>
- Atanasov AG, Wang JN, Gu SP, Bu J, Kramer MP, Baumgartner L, Fakhrudin N, Ladurner A, Malainer C, Vuorinen A, Noha SM (2013) Honokiol: a non-adipogenic PPAR γ agonist from nature. *Biochimica et Biophysica Acta (BBA)-General Subjects*. 1830(10): 4813–4819.
<https://doi.org/10.1016/j.bbagen.2013.06.021>
- Banday M Z, Sameer AS, Nissar S (2020) Pathophysiology of diabetes: An overview. *Avicenna Journal of Medicine*. 10(04):174–188.
https://doi.org/10.4103/ajm.ajm_53_20
- BAPPENAS (2016) Indonesia Biodiversity Strategi and Action Plan 2015-2020. In Kementrian Perencanaan Pembangunan Nasional/ BAPPENAS. Jakarta.
https://www.researchgate.net/publication/307628498_Indonesian_Biodiversity_Strategy_and_Action_Plan_2015-2020?__cf_chl=tk=Qci_vxSoR7hWPHsg8Emxq4yB1j0BXOWjQruDRe_rdtc-1762918573-1.0.1.1-vSls7wsjHF_DAEi6vb7HBAXhu5SmevMAA_FmDYdplog
- Butt SM (2022) Management and treatment of type 2 diabetes. *International Journal of Computations, Information and Manufacturing (IJCIM)*. 2(1):15–27.
<https://doi.org/10.54489/ijcim.v2i1.71>
- Cahyaningsih R, Magos, BJ, Maxted N (2021) Gap analysis of Indonesian priority medicinal plant species as part of their conservation planning. *Global Ecology and Conservation*. 26:e01459.
<https://doi.org/10.1016/j.gecco.2021.e>

- 01459
- Caputo A, Kargina M (2022) A user-friendly method to merge Scopus and Web of Science data during bibliometric analysis. *Journal of Marketing Analytics*. 10(1):82–88. <https://doi.org/10.1057/s41270-021-00142-7>
- Dafriani P, Karamika M, Anggraini SS, Marlinda R (2020) The potential of noni (*Morinda citrifolia*) in lowering blood glucose levels in diabetes mellitus patients. *Bioeduscience*. 4(2):120–123. <https://doi.org/10.22236/j.bes/424919>
- Dewi I, Chodidjah C, Hussaana A (2023) Evaluation of *Clitoria ternatea* L. flower extract in preventing complications of diabetes mellitus. *Tropical Journal of Natural Product Research*. 7(10):4908–4911. <https://doi.org/10.26538/tjnpr/v7i10.28>
- Elya B, Basah K, Mun'im A, Yulastuti W, Bangu A, Septiana KE (2012) Screening of α -glucosidase inhibitory activity from some plants of Apocynaceae, Clusiaceae, Euphorbiaceae, and Rubiaceae. *Journal of Biomedicine and Biotechnology*. 2012:1–7. <https://doi.org/10.1155/2012/281078>
- Faried A, Kurnia D, Faried LS, Usman N, Miyazaki T, Kato H, Kuwano H (2007) Anticancer effects of gallic acid isolated from Indonesian. *International Journal of Oncology*. 30:605–613. <https://doi.org/10.3892/ijo.30.3.605>
- Fitriyah Y, Dasari D (2023) Analisis Bibliometrik: Tren realistic mathematics education dalam pembelajaran matematika di Indonesia (2012-2023). *Sustainable Jurnal Kajian Mutu Pendidikan*. 6(2):469–481. <https://doi.org/10.32923/kjmp.v6i2.3914>
- Garg P, Garg V (2023) Bibliometric analysis of the genus *jasminum*: Global status, research and trends. *Journal of Herbal Medicine*, 4:100711. <https://doi.org/10.1016/j.hermed.2023.100711>
- Hardt PD, Ewald N (2011) Exocrine pancreatic insufficiency in diabetes mellitus: A complication of diabetic neuropathy or a different type of diabetes? *Experimental Diabetes Research*. 2011. <https://doi.org/10.1155/2011/761950>
- Hartanti D, Budipramana K (2020) Traditional antidiabetic plants from Indonesia. *Ethnobotany Research and Applications*. 19:1–24. <https://doi.org/10.32859/era.19.34.1-24>
- Hendra R, Ahmad S, Sukari A, Shukor MY, Oskoueian E (2011) Flavonoid analyses and antimicrobial activity of various parts of *Phaleria macrocarpa* (Scheff.) Boerl fruit. *International Journal of Molecular Sciences*. 12(6):3422–3431. <https://doi.org/10.3390/ijms12063422>
- Hidayat R, Wulandari P (2021) Effects of *Andrographis paniculata* (Burm. F.) Extract on diabetic nephropathy in rats. *Reports of Biochemistry and Molecular Biology*. 10(3):445–454. <https://doi.org/10.52547/rbmb.10.3.445>
- Koltun V, Hafner D (2021) The h-index is no longer an effective correlate of scientific reputation. *PLoS ONE*. 16(6). <https://doi.org/10.1371/journal.pone.0253397>
- Li Y, Peng L, Gu W (2023) The published trend of studies on COVID-19 and diabetes: bibliometric analysis. *Frontiers in Endocrinology*. 14: p.1248676. <https://doi.org/10.3389/fendo.2023.1248676>
- Lovic D, Piperidou A, Zografou I, Grassos H, Pittaras A, Manolis A (2019) The growing epidemic of diabetes

- mellitus. *Current Vascular Pharmacology*. 18(2):104–109. <https://doi.org/10.2174/1570161117666190405165911>
- Meho LI, Yang K (2006) A new era in citation and bibliometric analyses: Web of Science, Scopus, and Google Scholar. <http://arxiv.org/abs/cs/0612132>
- Moral-muñoz JA, Herrera-viedma E, Santisteban-espejo A, Cobo MJ (2020) Software tools for conducting bibliometric analysis in science: An up-to-date review. *El Profesional de la Información*. 29(1):e290103. <https://doi.org/10.3145/epi.2020.ene.03>
- Nugroho AE, Andrie M, Warditiani NK, Siswanto E, Pramono S, Lukitaningsih E (2012) Antidiabetic and antihyperlipidemic effect of *Andrographis paniculata* (Burm. f.) Nees and andrographolide in high-fructose-fat-fed rats. *Indian Journal of Pharmacology*. 44(3):377–381. <https://doi.org/10.4103/0253-7613.96343>
- Nugroho AE, Lindawati NY, Herlyanti K, Widyastuti L, Pramono S (2013) Anti-diabetic effect of a combination of andrographolide-enriched extract of *Andrographis paniculata* (Burm. f.) Nees and asiaticoside-enriched extract of *Centella asiatica* L. in high fructose-fat fed rats. *Indian Journal of Experimental Biology*. 51(12):1101–1108. [https://nopr.niscpr.res.in/bitstream/123456789/24549/1/IJEB%2051\(12\)%201101-1108.pdf](https://nopr.niscpr.res.in/bitstream/123456789/24549/1/IJEB%2051(12)%201101-1108.pdf)
- Rahayuningsih N, Piranti P, Zustika DS (2022) Antidiabetic of mango (*Mangifera longipes* Griff.) leaves: methanol extract, water fraction, and ethyl acetate. *Indonesian Journal of Pharmaceutical Science and Technology*. 1(1):88. <https://doi.org/10.24198/ijpst.v1i1.36890>
- Rizvi AA, Kathuria A, Al Mahmeed W, Al-Rasadi K, Al-Alawi K, Banach M, Banerjee Y, Ceriello A, Cesur M, Cosentino F, Galia M, Goh SY, Janez A, Kalra S, Kempler P, Lessan N, Lotufo P, Papanas N, Santos RD, Rizzo M (2022) Post-COVID syndrome, inflammation, and diabetes. *Journal of Diabetes and Its Complications*, 36(11):1–5. <https://doi.org/10.1016/j.jdiacomp.2022.108336>
- Soetikno V, Sari FR, Veeraveedu PT, Thandavarayan RA, Harima M, Sukumaran V, Lakshmanan AP, Suzuki K, Kawachi H, Watanabe K (2011) Curcumin ameliorates macrophage infiltration by inhibiting NF- κ B activation and proinflammatory cytokines in streptozotocin induced-diabetic nephropathy. *Nutrition and Metabolism* (Vol. 8). <https://doi.org/10.1186/1743-7075-8-35>
- Swastini DA, Martien R, Fachiroh J, Nugroho AE (2023) Bibliometric analysis of Basella ssp. as an antioxidant. *BIO Web of Conferences*. 75:3–10. <https://doi.org/10.1051/bioconf/20237501001>
- Triastuti A, Park HJ, Choi J (2009) *Phaleria macrocarpa* suppresses oxidative stress in alloxan-induced diabetic rats by enhancing hepatic antioxidant enzyme activity. *Natural Product Sciences*. 15(1):37–43. <https://www.koreascience.kr/article/JAKO200914852871182.view?orgId=anpor>
- Wediasari F, Nugroho GA, Fadhilah Z, Elya B, Setiawan H, Mozef T (2020) Hypoglycemic effect of a combined *Andrographis paniculata* and *Caesalpinia sappan* extract in streptozocin-induced diabetic rats. *Advances in Pharmacological and Pharmaceutical Sciences*. 2020. <https://doi.org/10.1155/2020/8856129>
- Widowati W, Darsono L, Lucianus J,

- Setiabudi E, Obeng S, Stefani S, Wahyudianingsih R, Reynaldo TK, Gunawan R, Riski, WC, Novianto A, Sari WKH, Rizal R (2023) Butterfly pea flower (*Clitoria ternatea* L.) extract displayed antidiabetic effect through antioxidant, anti-inflammatory, lower hepatic GSK-3 β , and pancreatic glycogen on Diabetes Mellitus and dyslipidemia rat. *Journal of King Saud University - Science*. 35(4):102579. <https://doi.org/10.1016/j.jksus.2023.102579>
- Widowati W, Wargasetia TL, Afifah E, Mozef T, Kusuma HSW, Nufus H, Arumwardana S, Amalia A, Rizal R (2018) Antioxidant and antidiabetic potential of *Curcuma longa* and its compounds. *Asian Journal of Agriculture and Biology*. 6(2):149–161. <https://asianjab.com/journal/index.php/ajab/article/view/445>
- Yusuf AP, Zhang JY, Li JQ, Muhammad A, Abubakar MB (2022) Herbal medications and natural products for patients with covid-19 and diabetes mellitus: Potentials and challenges. *Phytomedicine Plus*. 2(3):100280. <https://doi.org/10.1016/j.phyplu.2022.100280>