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MAPPING RESEARCH ON FACTORS ASSOCIATED WITH THE INCIDENCE OF DIABETES MELLITUS: A BIBLIOMETRIC ANALYSIS USING VOSVIEWER

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ABSTRACT
Diabetes mellitus is one of the most serious non-communicable diseases affecting communities worldwide. The disease is closely associated with unhealthy lifestyle behaviors. This study aimed to analyze and visualize the research landscape on factors associated with the incidence of diabetes mellitus published between 2021 and 2025 using bibliometric analysis with Publish or Perish and VOSviewer. This study utilized Google Scholar data published between 2021 and 2025 and conducted a bibliometric analysis using the Publish or Perish and VOSviewer applications. The search yielded 200 publications, all of which met the inclusion criteria and were included in the bibliometric analysis. The bibliometric analysis of factors associated with the incidence of diabetes mellitus over the past four years identified eleven major research clusters. The highest number of publications was recorded in 2023 and 2025, with 94 articles (47%), followed by 2024 with 42 articles (21%), 2022 with 35 articles (17.5%), and 2021 with 29 articles (14.5%). Publications related to factors associated with the incidence of diabetes mellitus indexed in Google Scholar increased by the end of 2025, indicating sustained research interest in this topic. The most frequently investigated variables in recent years include obesity, white sugar consumption, and family history.

Keywords: bibliometric analysis; diabetes mellitus; risk factors

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INTRODUCTION

According to the World Health Organization (WHO, 2022), diabetes mellitus (DM) is one of the most prevalent diseases worldwide and ranks among the leading priorities in research on degenerative diseases. The WHO estimates that more than 346 million people globally are living with diabetes (Raya & Barat, 2024). Diabetes mellitus is a non-communicable disease commonly found among older adults, with its incidence increasing annually. It is a chronic metabolic disorder characterized by elevated blood glucose levels, often accompanied by classical symptoms such as sweet-smelling urine. The disease is primarily caused by either relative or absolute insulin deficiency and is influenced by environmental factors, including obesity, excessive food intake, inadequate nutrition, physical inactivity, stress, and aging (Lestari & Zulkarnain, 2021; Utara et al., 2025; Di & Sumberwringin, 2025).

Diabetes mellitus is a chronic degenerative disease that has a substantial impact on the global population. It is widely recognized as a major contributor to serious health complications, including cardiovascular disease, kidney failure, visual impairment, gangrene, and cerebrovascular disorders (Syahfitri, 2024). Furthermore, diabetes mellitus is one of the four major non-communicable diseases prioritized by global health organizations (Mellitus et al., 2024). Diabetes mellitus is also a leading cause of mortality, accounting for more than 1.6 million deaths annually worldwide. Its prevalence continues to increase globally, with Indonesia ranking seventh among countries with the highest number of diabetes cases. According to the International Diabetes Federation (IDF), approximately 425 million people aged 20–79 years (8.8% of the global population) were living with diabetes in 2019. In Indonesia, the number of individuals with type 2 diabetes was estimated at

8.4 million in 2010 and is projected to increase to 21.3 million by 2030. followed by those aged 65–74 years (6.0%). The quality of life of patients with diabetes mellitus is influenced by various factors, including sociodemographic characteristics, glycemic control, comorbidities, complications, duration of illness, treatment type, and self-management. In addition to physical manifestations, type 2 diabetes is frequently associated with psychological symptoms such as anxiety, stress, depression, sleep disturbances, appetite changes, psychomotor disorders, difficulty concentrating, anhedonia, fatigue, hopelessness, helplessness, and suicidal ideation (Febriyana et al., 2024).

Diabetes mellitus is a chronic disease influenced by genetic, behavioral, physiological, and environmental factors (Febriyana et al., 2024). Considering the increasing burden of diabetes mellitus in Indonesia, effective prevention and management strategies are essential. The continuous rise in diabetes cases presents significant challenges to healthcare providers and has considerable consequences for individual well-being, household economies, and national healthcare systems. Therefore, understanding research trends related to the factors associated with diabetes mellitus is important for identifying knowledge gaps and guiding future research priorities. This study aimed to analyze and visualize the research landscape on factors associated with the incidence of diabetes mellitus published between 2021 and 2025 using bibliometric analysis with Publish or Perish and VOSviewer.

METHOD

This study employed a bibliometric approach using Google Scholar as the primary data source for publications published between 2021 and 2025. Bibliometric analysis is a quantitative method used to evaluate scientific publications and measure research productivity, impact, and knowledge development. Data retrieval was conducted using the Publish or Perish software, while visualization and network mapping were performed using VOSviewer. The literature search was conducted on March 16, 2026, using the keywords "analysis," "factors," and "diabetes mellitus." Articles indexed in Google Scholar were retrieved and exported in RIS format for further processing. The final dataset was imported into VOSviewer to generate bibliometric maps, including keyword co-occurrence networks and research clusters. VOSviewer was also used to identify relationships among keywords, visualize research trends, and construct bibliometric networks based on co-occurrence analysis. Irrelevant terms were excluded during data cleaning to improve the quality of visualization and interpretation (Van Eck & Waltman, 2020). A total of 200 publications were retrieved using the predefined search strategy. After verifying that all records met the inclusion criteria (Google Scholar-indexed publications published between 2021 and 2025 with citation information), all 200 publications were included in the final bibliometric analysis.

RESULT

The study analyzed secondary metadata obtained from Google Scholar using the keywords "analysis," "factors," and "diabetes mellitus." Publications included in the analysis met the inclusion criteria of being indexed in Google Scholar, published between 2021 and 2025, and received citations. Bibliometric analysis was conducted using Publish or Perish and VOSviewer to identify publication trends and research themes related to factors associated with the incidence of diabetes mellitus.

A total of 200 publications were successfully retrieved from Google Scholar using the Publish or Perish software based on the predefined search strategy. These publications formed the dataset for subsequent bibliometric mapping and network visualization.

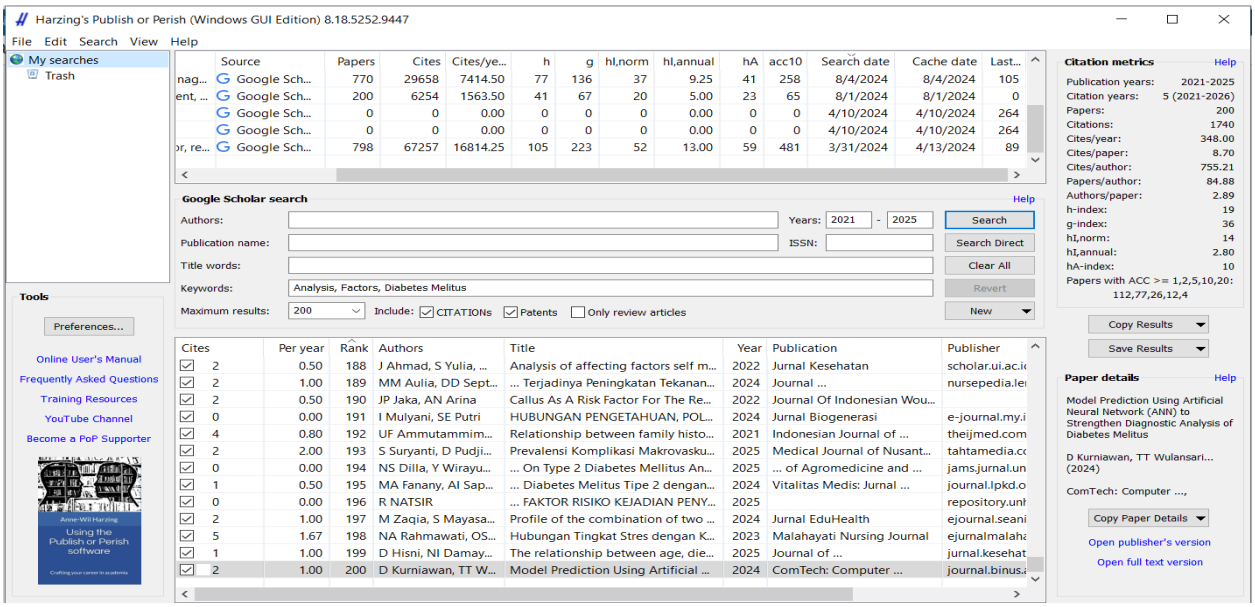


Figure 1. PoP exposure according to the inclusion criteria Analysis, Factors, Diabetes Mellitus. The exposure in Figure 1 shows that 200 articles have been downloaded from 2021 to 2025 with the specified inclusion criteria obtained 1740 cited articles, citations per year 348.00 citations per paper 8.70, citations per researcher 755.21, papers per author 84.88, h index 19, g index 36, hA index 10.

Based on Figure 1 above, which shows 200 articles from various journals facilitated by Publish or Perish, the next analysis was conducted to determine the publication trends of research on the topic of analyzing factors related to the incidence of diabetes mellitus in Google Scholar metadata. The analysis presented consists of the year of publication, the number of documents, and the percentage per year.

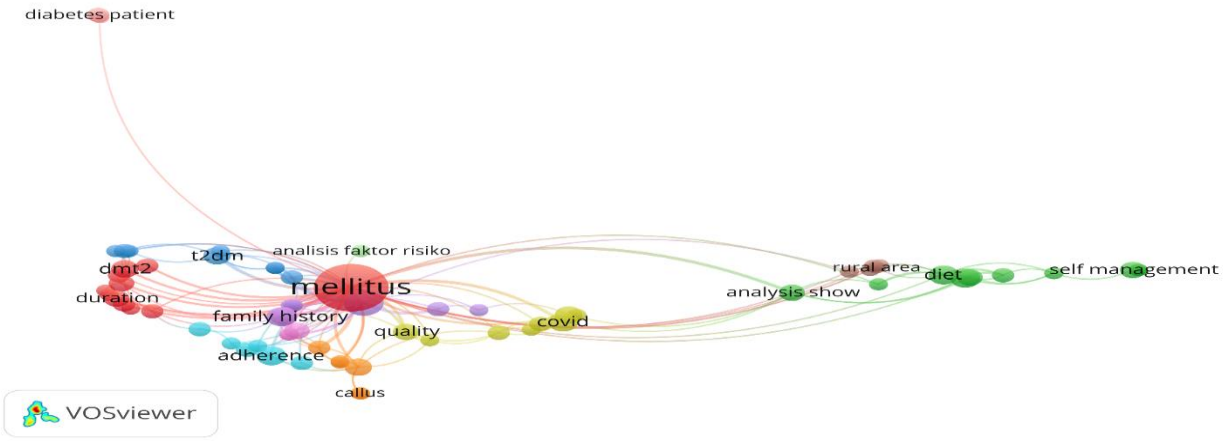
Table 1. Results of the description of the quantity of research papers analyzing factors related to the incidence of Diabetes Mellitus from Google Scholar metadata for four years from 2021 to 2025 that are indexed and have been cited.

Publication Year	Number of Documents	Percentage (%)
2021	29	14.5%
2022	35	17.5%
2023	47	23.5%
2024	42	21%
2025	47	23.5%
Total	200	100%

Table 1 illustrates that the publication of research results on factors was the most in 2023 and 2025, with 94 articles (47%), while in 2021, 2022, and 2024 there was a decline. The explanation of the research results presented in Table 1 answers the research question regarding the development of research publications on factors related to the incidence of Diabetes Mellitus. Analysis of published research articles in the last four years, the highest quantity was in 2023 and 2025. In 2021, there was a decline due to the COVID-19 pandemic, which was able to halt various social activities, including research. Furthermore, researchers tended to shift to the COVID-19 phenomenon. Other scientific fields not directly related to COVID-19 began to be displaced (Riccaboni and Verginer, 2022). The impact of Covid-19 has been felt worldwide, with all social activities being shut down due to lockdown policies, including social and health research (Sohrabi et al., 2020); (Cosentino, Marenzi, and Chiesa, 2022); however, the Covid-19 pandemic provides an opportunity for further researchers to examine the potential positive impacts of Covid-19 (Younis et al., 2023). Research on factors related to the incidence of Diabetes Mellitus until the end of 2025 remains in demand based on articles cited by academics.

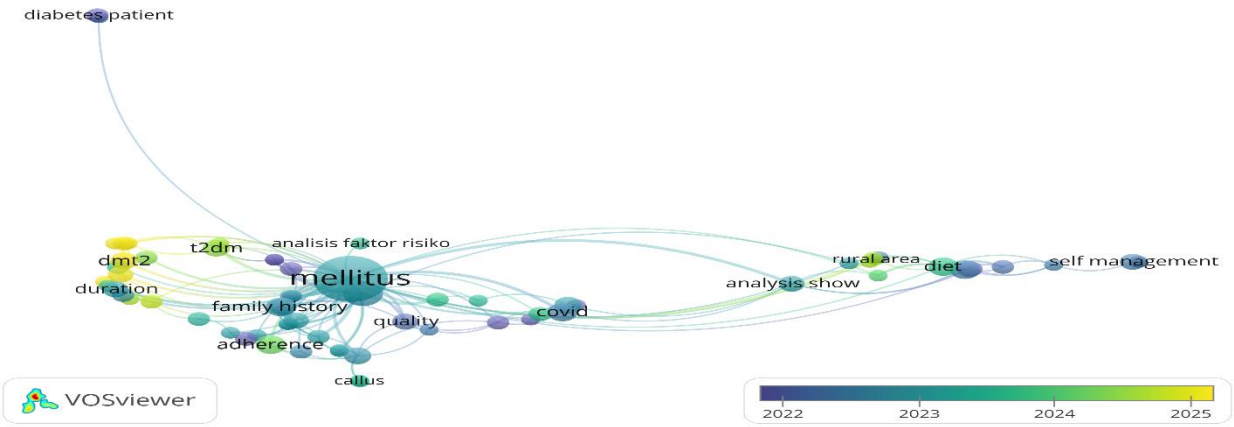
2. Results of Mapping Research Publications Using Vosviewer with Network, Overlay and Density Visualizations

a. Figure 1. Visualization of Topic Areas Using VOS-Viewer with Network Visualization (Source: VOS-Viewer)



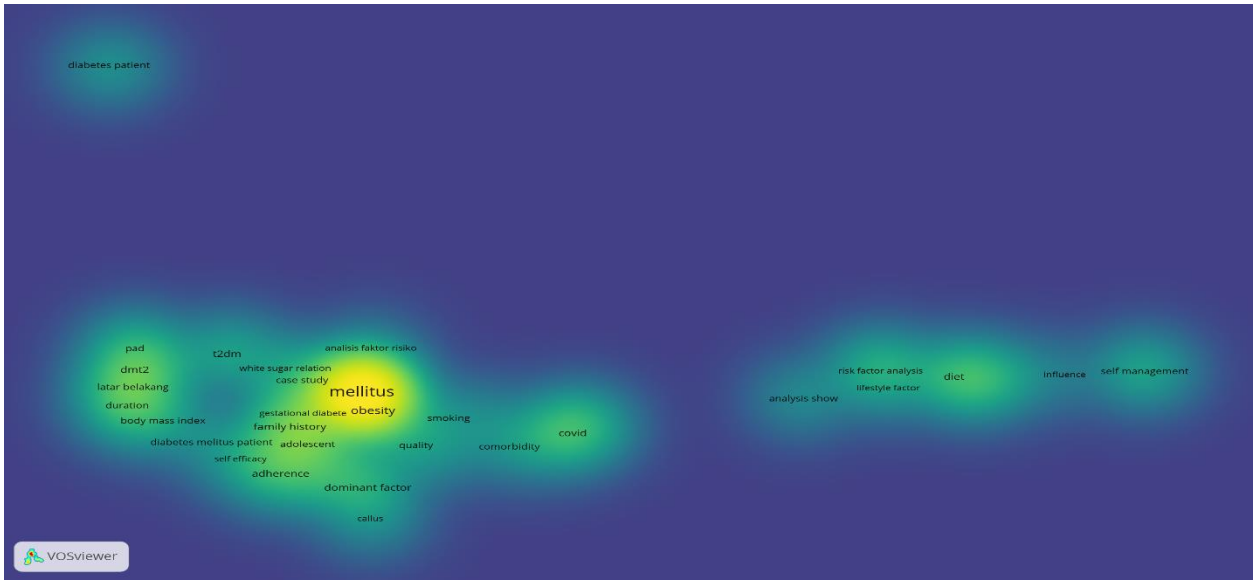
Viewed based on the primary variable, Diabetes Mellitus, shown in red, its closest variable is duration. The primary variable, shown in green, is associated with related variables such as diet and self-management. The yellow variable represents related variables such as quality of life and COVID-19. The blue variable represents family history, and the light blue variable represents adherence.

b. Figure 2. Topic Area Visualization Using VOS-Viewer with Overlay Visualization (Source: VOSViewer)



Based on the overlay visualization, keywords are indicated by colored circles. When a slogan appears in a title and is unique, there is a positive correlation between the size of the circle and the slogan. Therefore, the presence of letters and circles influences their size. The letters and circles increase in size if the slogan appears more frequently.

c. Figure 3. Topic Area Visualization Using VOS-Viewer Using Density Visualization (Source: VOSViewer)



Based on the Vos-viewer analysis display using the Density method, there are 11 clusters as follows: 1. Cluster one. Blood glucose level, body mass index, sex, and duration 2. Cluster two. Depression, diet, quality of life, lifestyle factor, self-management, stress 3. Cluster three. White sugar relation, 4. Cluster four. Comorbidity, Covid, Demographic factor, life, quality. 5. Cluster five. Family history, obesity, smoking. 6. Cluster six. Adherence, self-efficacy, employee. 7. Cluster seven. Compliance, dominant factor. 8. Cluster eight. Rural area, smoking habit, chronic disease management. 9. Cluster nine. Adolescent, unhealthy lifestyle, environmental factor. 10. Cluster ten. Associate factor, diabetes patient. 11. Cluster eleven. Risk factor analysis.

DISCUSSION

The network visualization presented in Figure 1 illustrates the relationships among keywords associated with factors related to the incidence of diabetes mellitus. The bibliometric analysis identified eleven major research clusters representing various themes in diabetes mellitus research. Keywords such as diabetes mellitus, obesity, family history, body mass index, pregnancy, and depression were interconnected within the network, indicating that these variables are frequently investigated together in studies examining diabetes mellitus risk factors. These findings are consistent with previous studies demonstrating that obesity, genetic predisposition, and unhealthy lifestyle behaviors remain the dominant determinants of diabetes mellitus worldwide (Sun et al., 2022; International Diabetes Federation, 2025).

The density visualization revealed that research conducted between 2021 and 2025 primarily focused on common risk factors, including obesity, family history, and sugar consumption. In contrast, topics such as depression, body mass index, and gestational diabetes exhibited lower research density, suggesting that these areas remain relatively underexplored. Recent evidence indicates that psychological factors, mental health conditions, and gestational diabetes are increasingly recognized as important contributors to diabetes risk, although their representation in the scientific literature remains relatively limited compared with traditional metabolic risk factors (American Diabetes Association, 2025; Young-Hyman et al., 2022).

Furthermore, the overlay visualization demonstrates the temporal evolution of research trends throughout the study period. The findings indicate that recent publications continue to focus predominantly on classical risk factors for diabetes mellitus, whereas studies examining psychological factors, family history, and anthropometric variables have shown relatively slower

development. Similar bibliometric studies have reported that diabetes research continues to emphasize metabolic and lifestyle-related determinants, while multidimensional factors such as psychosocial conditions, environmental exposures, and behavioral interventions remain emerging research topics requiring greater scientific attention (Donthu et al., 2021; Moral-Muñoz et al., 2020; Zhu & Liu, 2023).

The frequency of keyword occurrence showed that diabetes mellitus, risk factors, and analysis were the most frequently used terms in publications during the study period, reflecting their central role in current diabetes mellitus research. Conversely, several specific variables appeared less frequently, indicating the need for further investigation to strengthen the evidence regarding factors associated with the incidence of diabetes mellitus. This finding aligns with recent epidemiological reports emphasizing the growing burden of diabetes worldwide and the necessity of expanding research toward behavioral, psychosocial, environmental, and genetic determinants to support comprehensive prevention strategies (World Health Organization, 2024; International Diabetes Federation, 2025).

The bibliometric approach using Publish or Perish and VOSviewer provided a comprehensive overview of publication trends, keyword relationships, and emerging research themes. Beyond mapping the development of scientific knowledge, bibliometric analysis enables researchers to identify influential research areas, collaboration networks, and knowledge gaps that can guide future investigations and evidence-based decision-making. Similar studies have demonstrated that bibliometric techniques are valuable tools for evaluating research performance, identifying emerging topics, and informing future research priorities in health sciences (Donthu et al., 2021; Aria & Cuccurullo, 2021; Moral-Muñoz et al., 2020).

The present findings also demonstrate that obesity remains the most prominent keyword associated with diabetes mellitus, reflecting the growing concern regarding the increasing prevalence of obesity worldwide. Excess adiposity contributes to insulin resistance through chronic low-grade inflammation, altered adipokine secretion, and impaired glucose metabolism, making obesity one of the strongest modifiable risk factors for type 2 diabetes mellitus. Likewise, family history consistently appeared as a central keyword, emphasizing the interaction between genetic susceptibility and environmental influences in diabetes development. Recent epidemiological studies have confirmed that individuals with a family history of diabetes have a substantially greater lifetime risk of developing the disease, particularly when combined with obesity and sedentary lifestyles (Magliano et al., 2022; International Diabetes Federation, 2025).

Another notable finding is the relatively limited occurrence of psychological variables, including depression and stress, despite accumulating evidence demonstrating their significant influence on diabetes incidence and disease progression. Psychological distress contributes to unhealthy lifestyle behaviors, poor treatment adherence, hormonal dysregulation, and chronic inflammation, all of which increase the likelihood of developing diabetes mellitus. The lower density of these keywords suggests that psychological determinants remain underrepresented in diabetes research compared with traditional metabolic risk factors. This finding indicates an important opportunity for future multidisciplinary studies integrating behavioral science, psychology, and endocrinology (American Diabetes Association, 2025; Gonzalez et al., 2023).

The bibliometric mapping also identified self-management, adherence, and quality of life as emerging research themes. These findings indicate a gradual shift from research focusing primarily on disease etiology toward studies emphasizing long-term disease management and patient-centered care. Effective diabetes self-management education has consistently been associated with improved glycemic control, enhanced treatment adherence, and better quality of life. Consequently, future

diabetes research should continue integrating educational, behavioral, and digital health interventions to improve patient outcomes (Powers et al., 2022; Davies et al., 2022).

Furthermore, the emergence of keywords related to COVID-19 reflects the considerable influence of the pandemic on diabetes research during the early years of the study period. Previous investigations reported that individuals with diabetes experienced higher morbidity and mortality during the COVID-19 pandemic, prompting researchers to examine interactions between metabolic disorders, immune dysfunction, and infectious diseases. Although interest in COVID-19-related diabetes research has gradually declined, the pandemic has encouraged broader investigations into chronic disease resilience, telemedicine, and remote patient monitoring (Khunti et al., 2021; World Health Organization, 2024).

From a methodological perspective, the application of Publish or Perish combined with VOSviewer proved valuable for identifying publication patterns, collaboration structures, and evolving research themes. Bibliometric visualization facilitates the identification of highly connected keywords and emerging research hotspots while simultaneously revealing underexplored topics that warrant further investigation. Similar studies have concluded that bibliometric methods provide robust evidence for evaluating scientific productivity and supporting strategic research planning, particularly in rapidly evolving health-related disciplines (Donthu et al., 2021; Lim et al., 2022; Firdaus et al., 2024).

Overall, the present study provides a comprehensive overview of the research landscape concerning factors associated with diabetes mellitus between 2021 and 2025. While traditional risk factors such as obesity, family history, and dietary behavior continue to dominate the literature, comparatively limited attention has been directed toward psychosocial determinants, environmental exposures, digital health interventions, and precision prevention strategies. Addressing these research gaps may facilitate the development of more comprehensive prevention programs and contribute to reducing the global burden of diabetes mellitus in the future (International Diabetes Federation, 2025; American Diabetes Association, 2025).

CONCLUSION

This bibliometric analysis identified eleven major research clusters related to factors associated with the incidence of diabetes mellitus in publications indexed by Google Scholar between 2021 and 2025. The increasing number of publications observed toward the end of the study period indicates sustained scientific interest in this topic. Obesity, sugar consumption, and family history were the most frequently investigated factors, whereas depression, body mass index, and gestational diabetes received comparatively less attention.

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