DOI:10.34084/bshr.993099 e-ISSN 2587-1641

Journal of Biotechnology and Strategic Health Research

Araştırma Makalesi /Research Article

http://dergipark.org.tr/tr/pub/bshr

Collaborative Network Analysis and Bibliometric Analysis of Publications on Diabetic Foot Infection

Diyabetik Ayak Enfeksiyonu İle İlgili Yayınların İşbirliğine Dayalı Ağ Analizi ve Bibliyometrik Analizi

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Geliş Tarihi / Received : 08-09-2021 **Kabul Tarihi / Accepted:** 08-10-2021 **Yayın Tarihi / Online Published:** 30-12-2021

Gürler M., Alkan S., Özlü C., Aydın B. Collaborative Network Analysis and Bibliometric Analysis of Publications on Diabetic Foot Infection, J Biotechnol and Strategic Health Res. 2021;5(3):194-199

Özet

Amaç Diyabetik ayak enfeksiyonları (DFE), hastalar ve sağlık sistemi için büyük bir küresel yüke neden olur. Mortalitenin önemli bir nedeni olan DFE'nın özelliklerini tam olarak anlamak önemlidir. Bu çalışma, DFE ile ilgili yapılan çalışmaları incelemeyi ve bundan sonraki çalışmalara rehberlik etmeyi amaçlamıştır.

Materyal ve Metod Web of Science (WOS) veri tabanı 28 Şubat 2021 tarihine kadar yayın aramak için tarandı. Çalışmamızda elde edilen veriler çeşitli bibliyometrik göstergeler sunmak için analiz edilirken, haritalar VOS görüntüleyici programı (VOS) kullanılarak görselleştirildi. 'Diyabetik ayak' ve 'Diyabetik ayak hastalığı' veya 'Diyabetik ayak enfeksiyonu' anahtar kelimelerini içeren yayınlar incelenmiştir.

Bulgular Arama kriterlerine göre toplam 802 yayına ulaşıldı. En çok yayın ABD'dendi (%32,941). Yayınların çoğu makale (%63,6) ve endokrinoloji ve metabolizma alanındaydı. DFE ile ilgili yayınların atıf oranları yıllar içinde artmıştı.

Sonuç DFE ile ilgili artan akademik makalenin kalitesini değerlendirmek ve eksik çalışma konularına rehberlik etmek için bibliyometrik analiz daha yaygın olarak kullanılmalıdır.

Anahtar Kelimeler Ağ Analizi, Bibliyometrik Analiz, Diyabetik Ayak, Diyabetik Ayak enfeksiyonu.

Özet

Aim *Diabetic foot infections (DFI) result in a major global burden for patients and the health care system. It is important to fully understand the characteristics of DFI, which is a major cause of mortality. This study aimed to examine the studies on DFI and to guide future studies.*

Material and Method *The Web of Science (WOS) database was scanned to search for publications until February 28, 2021. While the data obtained in our study were analyzed to present various bibliometric indicators, the maps were visualized using the VOS viewer program (VOS viewer). The publications containing the keywords 'Diabetic foot' and 'Diabetic foot disease' or 'Diabetic foot infection' were examined.*

Results *A total of 802 publications were reached according to the search criteria. The most publications were from the USA (32.941%). Most of the publications were articles (63,6%) and were in endocrinology and metabolism area. The number of cite rates of publications on DFI have increased over the years.*

Conclusion *Bibliometric analysis should be used more widely to assess the quality of the growing academic paper on DFI and to guide missing study issues.*

Keywords *Bibliometric analysis, net work analysis, diabetic foot, diabetic foot infection.*

INTRODUCTION

Diabetes mellitus (DM) affects 422 million people worldwide, 8.5 percent of the adult population, and the prevalence of the condition is increasing faster in low- and middle-income countries. The global diabetes population is expected to grow from 171 million in 2000 to 366 million by 2030.[1] DM is a condition characterized by changes in carbohydrate, protein, and fat metabolism. Late complications may occur as a result of the long length of DM. Diabetic foot (DF) is a severe late complication of diabetes, and the risk of lower extremity amputation in this population is significantly higher than in the general population. DF concerns are widespread all over the world, and they have serious economic implications for patients, their families, and society.[1,2]

Diabetic foot infections necessitate close monitoring and coordination, ideally by a multidisciplinary foot-care team (2). An infectious diseases specialist or an internal diseases specialist should ideally be part of the team treating these diseases, or have ready access to one.[3] Optimal diabetic foot infection (DFI) treatment has the ability to minimize the incidence of infection-related morbidities, the need for and length of hospitalization, and the occurrence of major limb amputation.[4] Regrettably, these infections are often treated ineffectively.[5] This may be due to a lack of experience and understanding about existing diagnostic and therapeutic methods, a lack of resources allocated to the issue, or a lack of efficient multidisciplinary collaboration. Guidelines on the prevention of foot ulcers in people with diabetes, for example (The International Working Group on the Diabetic Foot IWGDF 2019 update) include the general management of the DF and diabetic foot ulceration DFU to help relieve medical morbidity, psychological distress, and financial costs.[6] However, in nearly all cases, providing high-quality treatment is no more complicated or costly than providing inadequate care and the consequences.[7]

The management of DFIs includes assessing and evaluating the seriousness of the infection as a basis for deciding on the best treatment plan.[8] Osteomyelitis (OM) is a highly complex and problematic disease that needs its own treatment. The infection should be assessed on three levels: the patient as a whole, the affected limb or foot, and the infected wound. The goal is to determine the infection's clinical degree and microbial etiology, the wound's biology or pathogenesis, any contribution of modified foot biomechanics to the wound's cause (and thus its ability to heal), any involvement of vascular (particularly arterial) disease, and the existence of any systemic possible consequences of infection. An initial progress report on a DFU classification method for research purposes was recently published by the International Consensus on the Diabetic Foot.[9] PEDIS (perfusion, extent/size, depth/tissue loss, infection, and sensation) is an acronym that summarizes the main elements. Grade 1 (no infection), 2 (involvement of skin and subcutaneous tissue only), 3 (advanced cellulitis or deeper infection), and 4 (presence of a systemic inflammatory response syndrome) are the infection classification. DFIs may advance quickly. Consequently, empiric antibiotic therapy should start for most DFIs while waiting for confirmation of cultures (and any other diagnostic studies). Most DFI patients need some form of surgical procedure in addition to antimicrobial therapy; these procedures vary from bedside sharp debridement to more comprehensive operative soft-tissue and bone resection.

Briefly, priorities must be establish new strategies for maintaining metabolic stability, optimizing ulcer-free, hospital-free, and activity-rich days.[10]

The aim of this study was to examine the studies on DFD from 1951–2021 using a specifically developed software to quantitatively analyse data from the Web of Science database in terms of (1) numbers of published items and citations (2) country specific publications (3) international collaboration and (4) publications by subject areas and journals.

MATERIAL and METHODS

Data source

Data were retrieved from the Science Citation Index-Expanded (SCI-E) of the Web of Science (WOS) database (https://www.webofknowledge.com). Comprehensive bibliometric data and the SCI-EXPANDED, SSCI, A&HCI, and ESCI citation index database were retrieved from the Web of Science (WOS) Core Collection, which is considered as the optimum database for bibliometrics.[11]

Çanakkale On Sekiz Mart University online library and digital resources were used to access information.

Search strategy

The dataset from the date since February 28, 2021 was obtained from the WOS Core Collection. The selected keywords (diabetic) or (Diabetes Mellitus) or (Type 2 Diabetes Mellitus) and (foot disease) or (foot infection) were used in the Wos search engine. English language were used for search and all document types were included the study. The aim of this study was to examine the studies on DFI using a specifically developed software to quantitatively analyse data from the Web of Science database in terms of (1) numbers of published items and citations (2) country specific publications (3) international collaboration and (4) publications by subject areas and journals.

Data collection

The titles, years of publication, names of authors, nationalities, affiliations, keywords, names of publishing journals, abstracts of each record, and citations within the publications downloaded from WOS, were saved as text files and imported into Microsoft Excel 2019.

Analysis

Retrieved data were analyzed to present various bibliometric indicators while maps were visualized using the VOS viewer technique.

RESULTS

A total of 802 publications were reached from WOS database according to the search criteria. The most publications were from the United States of America (USA) (32.941%), Turkey (9.412%) and England (8.431%). The U.S.A researchers are the most represented authors or co-authors in diabetic foot disease scientific publication. Most of the publications were articles (63,6%) and meeting abstract (16,9%). 19,4% of the publications were in endocrinology and metabolism area. Other study areas summarized in Figure.

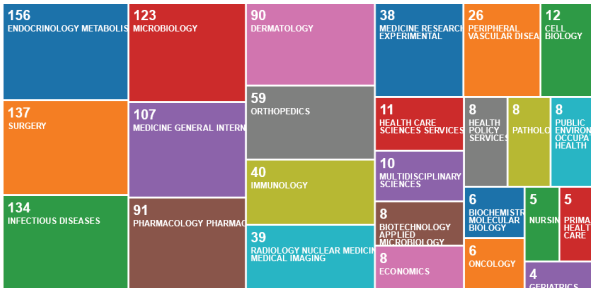
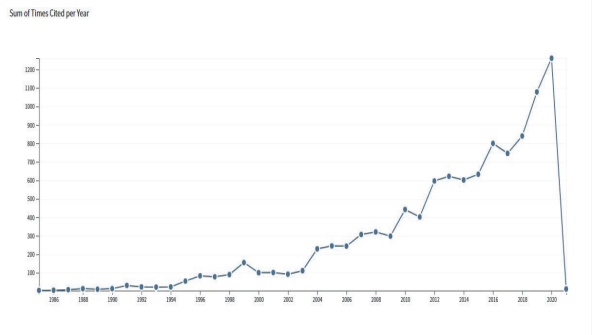


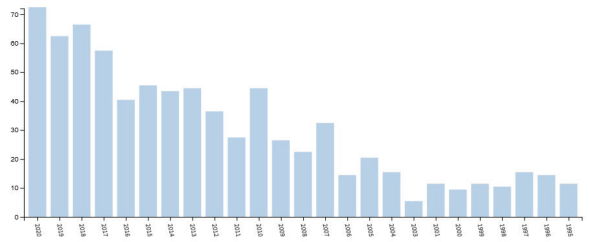
Figure 1. Summary of study areas of publications.

**This table was taken from the WOS database.

The average number of citations of these 802 publications was found to be 20,98. The H index was found to be 53. It was determined that the number of citing rates of publications on DFI had increased over the years (Graphic 1).

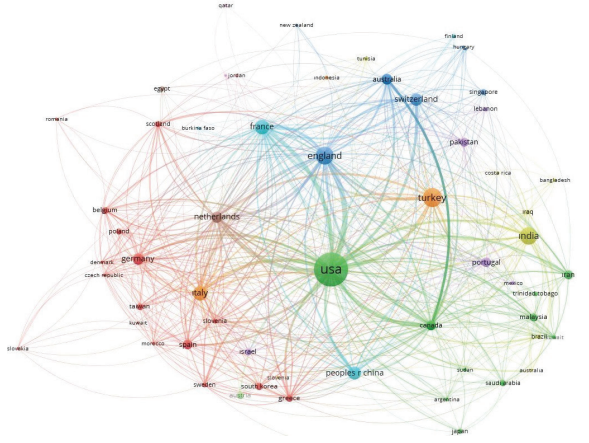


Graphic 1. Summary of citing over the years



Graphic 2. Summary of publications over the years.

As shown in Graphic 2, the publication outputs increased from 11 in 2003 to 33 in 2007 (first rapid growth stage). However, the outputs decreased to 22 in 2008 and did not increase to 58 until 2017 (second stage). The third stage (2017–2020) was the period with the highest growth, which has been increasing since then. Publication outputs demonstrated an increasing trend annually. This indicates that Diabetic Foot Disease has received increasing attention, and further research into Diabetic Foot Disease therapy is ongoing.



Graphic 3. Collaborative network analysis of countries according to citation and visualization with VOS viewer.

Finally, we looked at collaborations between all countries in the final 2021 year period. In order to analyse only articles with an important scientific impact, analysis was then performed using VosViewer software. Publications from the USA were the most cited publications (Graphic 3).

DISCUSSION

Diabetic foot infections are several human diseases and public health problem, which have morbidity, psychological distress, and financial costs.[6-8] The present study sought to provide a detailed evaluation of the published literature on DFI using large-scale data, bibliometric analysis method and density-equalizing mapping. The bibliometric analysis method is an analysis method frequently used in many research areas in recent years. With this method of work, the gaps of the work area can be seen and lead to future studies.[12,13] Although there were more than 100 bibliometric analyzes on DM in the Pubmed database, no bibliometric analysis on DFI was found in the available literature. The only similar study in the literature was on diabetic foot ulcers but did not include infection.[14] This study included publications until March 2020. Similar to our study, most publications were made from the USA. In our study, Turkey was the second country in publications rates on DFI. Surgery was the most common in terms of research areas.[14] In our study, endocrinology and metabolism was the most common study area.

The bibliometric analysis method allows to make holistic evaluations of scientific publications. By comparing previous studies, gaps in research areas can be identified and even comparisons can be made at the level of countries.[15-27] Internet databases are frequently used for bibliometric analysis. In fact, different databases can be analyzed and mapped with visualization methods.[18-25] While the WoS database included in Thomson Reuters' publications was the only database for bibliometric studies until the year 2004, the number of bibliometric databases increased with the establishment of Scopus and Google Scholar in 2004.[19,20] The WOS database offers approximately 20% less coverage than Scopus for citation analysis but provides more detailed information on citations prior to the year 1996.[21] However, not every database can be used for data visualization and mapping. The WOS database records the authors' links and stores certain information such as the authors' organization names, city, state, region numbers,

and countries. It is not possible to search for collaborations in the Pubmed database.[22] We also used the WoS database in our study that allows mapping and visualization.

Due to the increasing prevalence of DM and DFIs globally, there is a rapidly growing volume of research on this topic. As a result of our research, it has been shown that Turkey has more publications than many developed countries after the USA. The USA, Turkey, England, India and France were most leading countries on DFI publications. In a bibliometric analysis conducted only on DM in previous years, USA and England were the countries with the highest number of publications.[22]

The only similar article found in the available literature sought to analyze trends in foot and ankle studies published in top-cited general medical journals published from 2000 to 2017. In this study; 47 foot and ankle studies examined and diabetic foot ulcers, plantar fasciitis, and Achilles tendinopathy were reported as the most frequently published contents.[23] Another local study had analyzed diabetic foot disease research in Gulf Cooperation Council Countries by using the MEDLINE® database (National Library of Medicine, Bethesda, Maryland, USA) between January 1990 and December 2015.[24] Both of these studies had limited content and timeframe. Our study covers global studies up to 2021 and is the largest study published on this subject.

According to the analysis of countries' cooperation networks, the more scientific publications a country has produced, the wider its environment and the greater the cooperation, the thicker the connection line.[25] In our study, most of the top-cited publications were from the USA and it was determined that the line between the USA, England, Canada, and France was thicker. This means the co-citation of citing rates was higher than in other countries.

CONCLUSION

With the increase of the diabetes mellitus, bibliometric analysis should be used more widely in order to evaluate the quality of the increasing academic paper and to guide the missing study issues. From the treatment of DM to its pathogenesis and especially its long-term consequences as DFI, it is an important issue that needs to be investigated.

Limitations of the study

In our study, analyzes were made using the WOS database. However, as new articles are added to WOS every day due to the increasing number of publications, the data may reflect the information until the day of analysis. Additionally, only English language articles were evaluated in the study.

Conflict of interest

The authors declare no personal or financial conflict of interest.

Financial disclosure

No financial support was received.

Ethics approval

Since the literature survey model is used in the research, ethics committee approval is not required. Generally, in bibliometric type studies no ethical approval was required as there is no human and animal involvement.

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