

## ORIGINAL ARTICLE

## Analysis of Publications on Psoriasis and Tuberculosis

## Psöriazis ve Tüberküloz Konulu Yayınların Analizi

<sup>1</sup>Mustafa Serhat Şahinoğlu , <sup>2</sup>İrem Şahinoğlu , <sup>3</sup>Sevil Alkan 

<sup>1</sup>Manisa City Hospital, Infectious Diseases and Clinical Microbiology Clinic, Manisa, Turkey.

<sup>2</sup>Celal Bayar University, Department of Rheumatology, Manisa, Turkey.

<sup>3</sup>Çanakkale Onsekiz Mart University, Department of Infectious Diseases and Clinical Microbiology, Çanakkale, Turkey.

## Correspondence

Mustafa Serhat Şahinoğlu, Manisa City Hospital, Infectious Diseases and Clinical Microbiology Clinic, Manisa, Turkey.

E-Mail: [dserhatsahinoglu@gmail.com](mailto:dserhatsahinoglu@gmail.com)

## How to cite ?

Şahinoğlu MS, Şahinoğlu İ, Alkan S. Analysis of Publications on Psoriasis and Tuberculosis. Genel Tıp Derg. 2024;34(1):8-14.

## ABSTRACT

**Background:** Psoriasis is a relatively common inflammatory disease globally with systemic implications and the treatment of psoriasis has advanced rapidly in recent years. However, current treatments, especially anti-tumor necrosis factor (TNF) treatments, can lead to tuberculosis.

**Objectives:** This study's objective was to analyze tuberculosis and psoriasis-related literature that was published between 1970 and 2021 by using scientometric techniques.

**Methods:** In this bibliometric analysis study, the Web of Science database was used to find the articles on psoriasis and tuberculosis that were published between 1970 and 2021. The VOSviewer software program was used to generate visualization knowledge maps including co-citation, co-authorship, co-occurrence and keyword analysis.

**Results:** A total of 127 documents in the field of psoriasis and tuberculosis were indexed in the Web of Science database. The first reports were in 1971, but until 2004 there was no other publications. Since 2010 the number of publications has begun to increase. While most of the publications were articles (49.606%), 91.339% of them were published in Science Citation Index Expanded journals. 576 authors contributed to psoriasis and tuberculosis literature from 36 countries. The United States (n=26), Italy (n=21), Spain (n=12) were the first 3 countries in the number of publications. Most of the articles were from Dermatology (n=93, 73%) and Rheumatology (n=11, 9%) research areas.

**Conclusion:** As can be understood from this current study on psoriasis and tuberculosis, it has become more popular, especially with anti-TNF treatments. This study recommends focusing more on tuberculosis, especially in psoriasis and psoriatic arthritis patients receiving anti-TNF therapy.

**Keywords:** Bibliometric analysis, Psoriasis, Publications, Tuberculosis, Anti-TNF

## Öz

**Amaç:** Psöriazis, sistemik etkileri olan ve dünya çapında nispeten yaygın bir inflamatuvar hastalıktır ve psöriazis tedavisi son yıllarda hızla ilerlemiştir. Bununla birlikte, mevcut tedaviler, özellikle de anti tümör nekroz faktörü (TNF) tedavileri tüberküloza yol açabilir.

Bu çalışmanın amacı, 1970-2021 yılları arasında yayınlanan tüberküloz ve psöriazis ile ilgili literatürü bibliyometrik teknikler kullanarak analiz etmektir.

**Yöntemler:** Bu bibliyometrik analiz çalışmasında, 1970-2021 yılları arasında yayınlanan psöriazis ve tüberküloz ile ilgili makaleleri bulmak için Web of Science veri tabanı kullanıldı. VOSviewer yazılım programı, ortak atıf, ortak yazarlık, ortak oluşum ve anahtar kelime analizini içeren görselleştirme bilgi haritaları oluşturmak için kullanıldı.

**Bulgular:** Web of Science veri tabanında psöriazis ve tüberküloz konusunda toplam 127 belge indekslenmişti. İlk yayınlar 1971'deydi, ancak 2004 yılına kadar başka yayın yoktu. 2010 yılından itibaren yayın sayısı artmaya başlamıştı. Yayınların çoğu araştırma makalesi idi (%49,606) ve bunların %91,339'u Science Citation Index Expanded indeksli dergilerde yayınlanmıştı. Psöriazis ve tüberküloz literatürüne 36 ülkeden 576 yazar katkıda bulunmuştu. Amerika Birleşik Devletleri (n=26), İtalya (n=21), İspanya (n=12) yayın sayısında ilk 3 ülke olmuştu. Makalelerin çoğu Dermatoloji (n=93, %73) ve Romatoloji (n=11, %9) araştırma alanlarındandı.

**Sonuç:** Psöriazis ve tüberküloz üzerine yapılan bu güncel çalışmadan da anlaşılacağı üzere özellikle anti-TNF tedaviler ile daha popüler hale gelmiştir. Bu çalışma, özellikle anti-TNF tedavisi alan psöriazis ve psoriatik artrit hastalarında tüberküloza daha fazla odaklanılmasını önermektedir.

**Anahtar Kelimeler:** Bibliyometrik analiz, Psöriazis, Yayınlar, Tüberküloz, Anti-TNF

## Introduction

Mycobacterium tuberculosis causes tuberculosis (TB) disease and this disease is seen globally. TB is primarily a disease of the lungs but can affect almost any organ in the body (1). TB is one of the oldest known diseases and the leading communicable or infectious cause of global deaths (2). In 2020, an estimated 10 million people fell ill with tuberculosis worldwide. About 3 million of the 10 million estimated cases of TB that year were undiagnosed or were not formally reported to national authorities (3). Of the total number of people who develop TB each year, about 90% are adults, with more cases among men than women. The majority of TB patients reside in low- and middle-income

nations, however the disease exists everywhere (4). About a quarter of the global population is estimated to have been infected with TB (5), but most people do not develop TB disease and some clear the infection (6,7). A significant portion of the population is affected by latent tuberculosis infection (LTBI), defined as the absence of bacteriological and radiographic signs of disease with the presence of M. tuberculosis. However, only about 10% of these patients develop active tuberculosis in the general population (8). In an immunocompetent individual, the host defense mechanisms control Mycobacterium tuberculosis infection and induce the latent form of the disease. However, in the

presence of diseases or therapies, which exert an immunosuppressive effect, LTBI can be re activated (9).

Psoriasis is known as a hereditary, immune-mediated inflammatory disease that can affect the skin, joints, or both, and the management of psoriasis has advanced rapidly in recent years (9,10). Therefore, the treatment of this disease concerns not only dermatologists, but also various specialties. Psoriasis is an important disease because of its high prevalence, chronicity, disfigurement, disability and related comorbidities. It has a prevalence of 2–4% in Western adults (11). Psoriatic arthritis is the most common condition accompanying psoriasis and develops in up to 30% of patients with psoriasis (12,13).

PsA pathogenesis involves multiple different factors, including genetic, immunologic, and environmental factors (14). Understanding the function of the immune system in psoriasis and how the innate and adaptive immune systems interact has made it easier to manage this complicated condition, which has effects on patients beyond the skin (10). Interleukin (IL) 17 and IL-23 have been identified as important pathogenesis-promoting factors in psoriasis by immunological and genetic research. With a better understanding of the pathogenesis of psoriasis, various treatments such as anti-tumor necrosis factors (anti-TNFs), anti-IL-12, anti-IL-17 and anti-IL-23 agents have been used. The treatment of psoriasis disease has been revolutionized by immune targeting of these cytokines and tumor necrosis factor by biological treatments (15,16).

TNF- $\alpha$  is also an important cytokine in preventing TB infection and in keeping LTBI from becoming active disease. TNF- $\alpha$  is involved in the killing of mycobacteria by activating macrophages (17) and preventing the dissemination of infection by stimulating granuloma formation (18). Since TNF- $\alpha$  is involved in both protection against mycobacterial infection and TB pathogenesis, it is not surprising that the clinical use of TNF- $\alpha$  antagonists has been implicated in an increased rate of TB (19). The increased risk of LTBI associated with TNF inhibitors have long been known (9). As a result, international recommendations have suggested screening for TB before beginning treatment with any biological agents ever since then. The implementation of chemoprophylaxis in cases of LTBI and annual TB screenings thereafter have also been recommended (20,21). It is important to carefully consider the risks and benefits of beginning anti-TB treatment (9). However, the IL-17 and 23 blockade do not carry the same risk of TB reactivation as TNF- $\alpha$  inhibitors [9]. Although preclinical studies have shown that cytokines IL-17 and IL-23 have a possible role against infection with *M. tuberculosis* (22), data from clinical studies and post-marketing surveillance with drugs that inhibit these cytokines indicate that the risk of TB reactivation is not very significant (23,24).

Scientometric or bibliometric evaluations are utilized to learn about the past and present state of a studied field (25-28). Bibliometric analysis has emerged as one of the most widely used methods to evaluate the

quality, reliability and impact of scientific studies (27). Bibliometrics is an important tool to measure scientific output of an individual, institution or country using relevant parameters including quantity, impact factor and citation of published articles over time (29). While bibliometrics is not an infallible technique, it can serve as a valuable tool for identifying potentially under-researched areas in a discipline and guiding the allocation of resources by funding organizations (30).

This study's objective was to analyze TB and psoriasis-related literature that was published between 1970 and 2021 by using scientometric techniques. This study was planned to evaluate of publications in this field, especially after the increased use of anti-TNFs, IL 17 and IL-23 inhibitors.

### Material and Methods

This study is a retrospective bibliometric study. Web of Science (WoS) or Scopus databases are frequently used in bibliometric analyzes (15-17). Thomson Reuters the WoS Core Collection (Clarivate Analytics, Philadelphia, USA) (<http://webofknowledge.com>) was chosen to retrieve the data. The selected keywords were used for the research [(TI= (Psoriasis tuberculosis) or TI= (Psoriasis mycobacterium) or TI= (Psoriatic Tuberculosis) OR TI= (Psoriasis latent tuberculosis) and TI= (Psoriasis TB)]. The timespan included the years 1970 through 2021. The search was done on July 15, 2022.

The analysis covered all retrieved documents, including original articles, review articles, case reports, letters and meeting abstracts. From the data pool, only the original articles were taken. Unrelated articles were eliminated after manually reviewing the article titles and abstracts. A data pool was established after duplicate articles were eliminated. Publications were sorted and methodically evaluated by country, journal, year of publication, field of study, authors and affiliations.

The macro-geographical distribution of Psoriasis and Tb research in terms of countries and institutions was examined using the depicted network and frequency statistics. The micro-knowledge distribution properties were examined by fields, journals and authors. The study of the co-occurrence and clustering of keywords then revealed conceptual grounds and research hotspots. Visualization maps of this study was generated by VOSviewer software. This co-occurrence and co-citation tool were created by Eck and Waltman (31). The SPSS (version 13) was used for all other statistical analyses (SPSS Inc., Chicago, IL, US).

**Ethical Approval/Informed Consent:** The study complied with the Helsinki Declaration, which was revised in 2020. Ethics committee approval is not required as there is no human or animal research.

### Results

Between the years 1970 and 2021, a total of 127 documents on psoriasis and TB were indexed in the Wos database. The first reports were in 1971, but until 2004 there was no other publications. From 2010 the number of publications began to increase. But in

the years 2016 and 2017, the number of publications decreased again. The highest number of publications was in 2020 (n=18) (Figure 1).

Of these 127 articles, 112 were from the last 10 years. Most of the publications were articles (49.6%), meeting abstracts (19.6%), letters (18.8%) and review articles (8.6%). 93.701% of them published in English and 91.4% of them published in Science Citation Index Expanded journals. 576 authors from 36 countries contributed to the psoriasis and TB literature. The United States (n=26), Italy (n=21), Spain (n=12) were the most productive countries in the psoriasis and TB literature (Figure 2).

Especially in the last 10 years, following these three countries, Brazil, India, Taiwan, Türkiye and Romania are at the forefront in the number of publications (Table 1).

The University of California System (n=8) from the USA, Icahn School of Medicine at Mount Sinai (n=6) from the USA and Universidade de São Paulo from Brazil were the most productive affiliations on psoriasis and TB research (Table 2).

Most of the articles were from Dermatology (n=93, 73%) and Rheumatology (n=11, 9%) research areas. They were followed by Immunology (n=6, 5%), General Internal Medicine (n=5, 4%), Pharmacology Pharmacy (n=4, 3%) and the others (n=8, 6%). The documents were published in 58 different journals and mainly in Dermatology journals. The vast majority of the studies were published in the British Journal of Dermatology (n=22) and the Journal of the European Academy of Dermatology and Venereology (n=13) journals. They were followed by the Journal of the American Academy of Dermatology (n=9), International Journal of Dermatology (n=7), and Acta Dermato Venereologica (n=3). There were a total of 53 funding supports for psoriasis and tuberculosis studies. Pfizer funded most of the research (Table 3).

### Network Visualizations

The network analyses of the co-authorship among countries (Figure 3), citation map among countries (Figure 4) and among authors (Figure 5) are summarized below.

Countries connected by lines typically work cooperatively. Stronger cooperation is indicated by thicker lines. Countries that were represented by higher text or circle sizes generally collaborated internationally more.

### The Keyword Analysis

The keyword visualization map of articles with a minimum of 20 occurrence on psoriasis and TB is given in Figure 6. The bibliographic coupling visualization map of articles according to the keywords with a minimum of 10 occurrence on psoriasis and TB is given in Figure 7. Larger circle or font size representations of keywords in the articles had a comparatively strong association.

### Citation Analysis

These 127 publications which was included this study

were cited 1136 times totally (8.94 per document) and the mean of the Hirsch (H) index was 19. The citation number has rapidly grown since 2010, however, there was a decline in both the number of publications and the number of citations in 2016-2017 (Figure 8).

**Table 1.** List of the Publishing Countries and Number of Publications in Last Ten Years

Countries/Regions	Record Count	% of 112
The USA	23	20.53
Italy	20	17.86
Spain	12	10.71
Brazil	6	5.36
India	6	5.36
Romania	6	5.36
Taiwan	6	5.36
South Korea	5	4.46
Turkey	5	4.46
France	4	3.57
Germany	4	3.57
Greece	4	3.57

Showing 12 out of 53 countries

**Table 2.** The Leading Affiliations on Psoriasis and Tuberculosis Studies

Affiliations	Record Count	% of 127
University of California System	8	6.299
Icahn School of Medicine at Mount Sinai	6	4.724
Universidade de Sao Paulo	6	4.724
Victor Babes University of Medicine Pharmacy Timisoara	6	4.724
Case Western Reserve University	5	3.937
Hospital de La Princesa	5	3.937
University of Verona	5	3.937
Autonomous University of Barcelona	3	2.362
Boston Collaborative Drug Surveillance Program	3	2.362
Boston University	3	2.362

Showing 10 out of 294 entries; 5 record(s) (3.937%) do not contain data in the field being analyzed

**Table 3.** The Leading Funding Agencies on Psoriasis and Tuberculosis Studies

Funding Agencies	Record Count	% of 127
Pfizer	6	4.724
Fundacao De Amparo A Pesquisa Do Estado De Sao Paulo	4	3.150
Bristol Myers Squibb	3	2.362
European Commission	3	2.362
Abbott Laboratories	2	1.575
Celgene Corporation	2	1.575
Eli Lilly	2	1.575
European Commission Joint Research Centre	2	1.575
Janssen Biotech Inc	2	1.575
Johnson Johnson	2	1.575

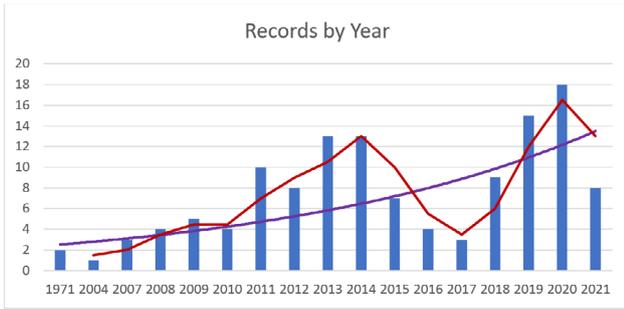


Figure 1. The Publications since 1971

\* Red line shows the moving average of the counts and the black line shows the logarithmic interpretation of the publications numbers.

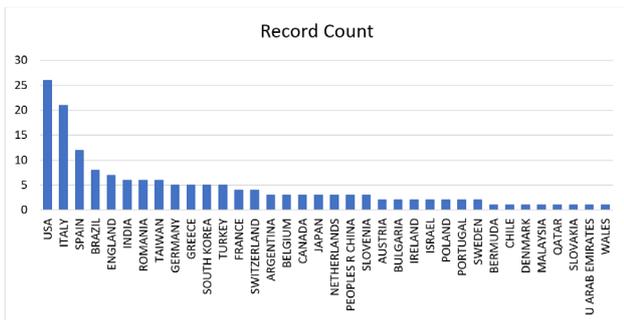


Figure 2. The Number of Publications According to the Publishing Countries

\* 5 record(s) (3.937%) do not contain data in the field being analyzed

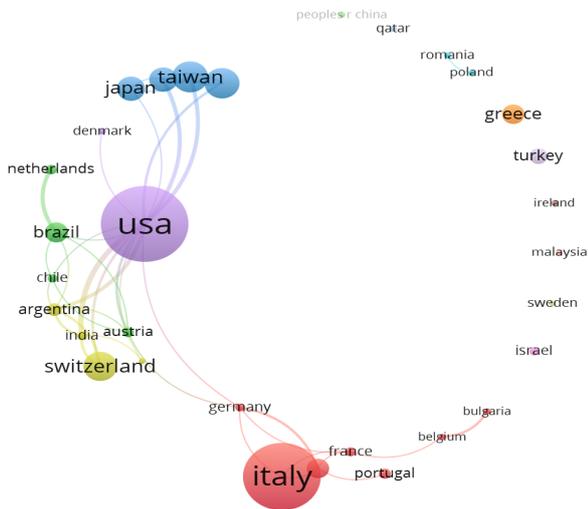


Figure 3. Network Visualization Map of Co-Authorship Among Countries with a Minimum of One Publication on Psoriasis and Tuberculosis

\*Countries connected by lines typically work cooperatively. Stronger cooperation is indicated by thicker lines. Countries that were represented by higher text or circle sizes generally collaborated internationally more.

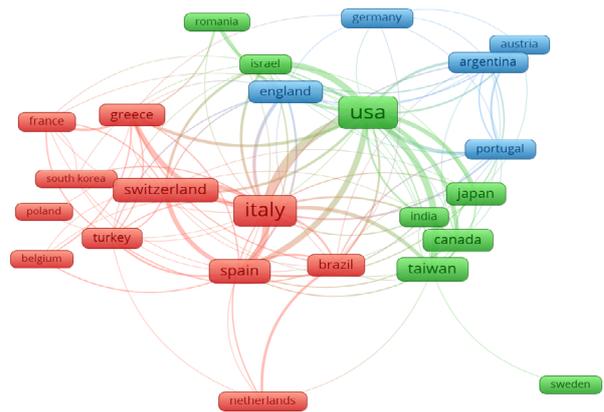


Figure 4. Network Visualization Map of Citation Map Among Countries with a Minimum of One Publication on Psoriasis and Tuberculosis

\* Countries connected by lines typically work cooperatively. Stronger cooperation is indicated by thicker lines. Countries that were represented by higher text or circle sizes generally collaborated internationally more.

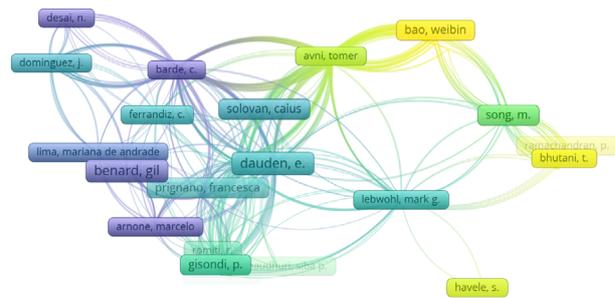


Figure 5. Citation Visualization Map Among Authors with a Minimum of 2 Publications and 10 Citations on Psoriasis and Tuberculosis

\*Lines connecting countries are indicative of citation. Authors represented with larger circle sizes or font sizes had relatively more citations. The most remarkable authors are shown in the figure.

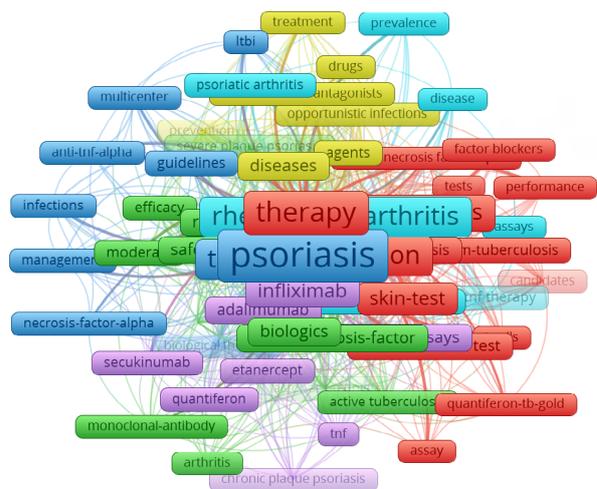


Figure 6. Keyword Visualization Map of Articles with a Minimum of 20 Occurrences on Psoriasis and Tuberculosis

\* Indicators of occurrence relations in articles include lines linking. The articles contained considerably more instances of keywords that were represented by greater circle or letter sizes.

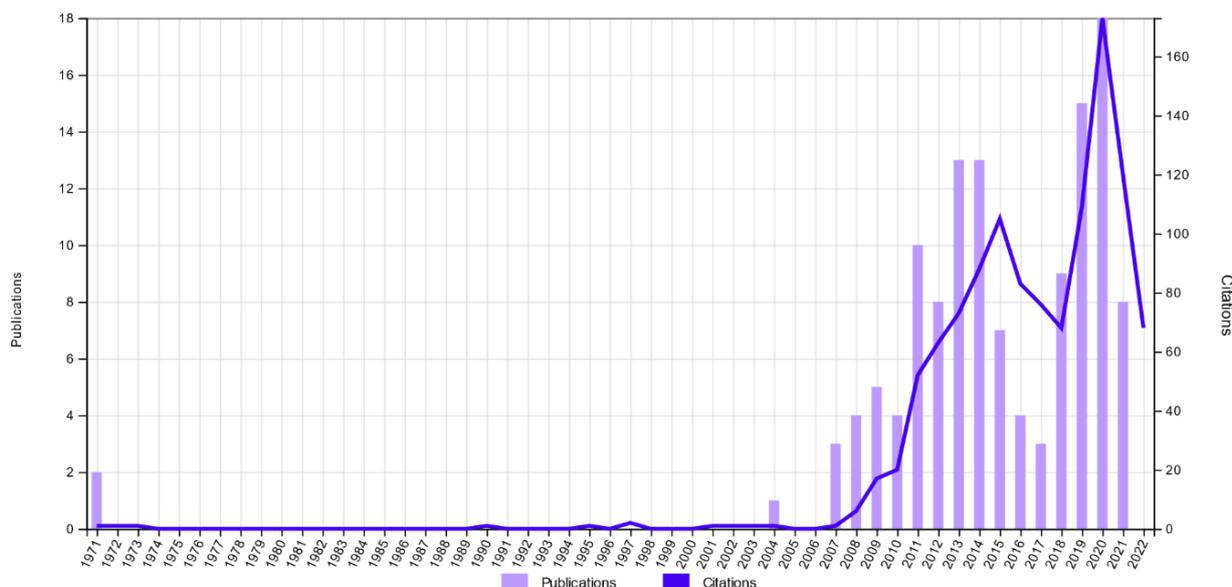


Figure 8. The Number of Publications and Citations by Years.

## Discussion

Scientific publications are crucial resources for discovering new medical knowledge and creating therapies. Researchers can form opinions about the amount and quality of the research field by analyzing publication activity. Researchers can do analyses about publication activities in relation to citations, journals, authors, etc. with the use of bibliometric analysis. It offers details about the examined field's structure in several categories (25,26). TB is hot topic in dermatology and rheumatology researches, and a risk of TB in patients with chronic immune-mediated inflammatory diseases treated with biologics increased (9,19). As far as we are aware, this paper is the first bibliometric analysis on psoriasis and TB, which may be helpful for future research. This study used qualitative and quantitative bibliometric network analysis to shed light on how psoriasis and TB studies have changed over time. The findings might serve as a starting point for a clearer understanding of how psoriasis and TB research has been progressing globally and could stimulate further interest particularly in developing countries. In order to provide information about publications and citations by organization, nation, and author, this bibliometric analysis summarized 127 publications on psoriasis and TB. The analysis covered 58 journals and 127 research articles with psoriasis and TB in their titles. The majority of the literature in this scientific topic was written after 2010 while the number of papers published until 2004 was quite low. The most productive countries in terms of psoriasis and TB research were the USA (n=26), Italy (n=21), Spain (n=12), Brazil (n=8) and England (n=7). Even if there were studies from different parts of the world, the dominance was in the USA and Europe (Figure 2).

In particular, it was seen that the USA has a strong cooperation with all other countries where there are publications of the studies. It is mostly seen that the USA has strong cooperation with Italy, Spain, Israel

and Taiwan (Figure 4). The lines represent worldwide collaboration networks, and the width of each line denotes the quantity or number of such connections. In our study, "words co-occurrence network" was created based on the frequency, association, and co-occurrence of each keyword in published documents on psoriasis and TB (Figure 3-5). The analysis' findings show that most research societies have already established a linked and tightly knit network of collaboration, especially among the scientifically developed nation. In another bibliometric study on tuberculosis, it has been reported that tuberculosis publications have increased in the last 10 years, and the most publications were made by the USA. The reason for this was mentioned as the importance given to TB research resources by the USA (32). Most of the funding agencies were pharmaceutical companies. Academic institutions that conduct scientific studies with pharmaceutical companies are shown in figure-8. Accordingly, it can be thought that the current support is more for the USA and Europe.

Cumulatively, more than 1/3 of the reported TB cases in the world occur in the BRICS (Brasil, Russia, India, China, South Africa) countries (33), and it is reported that the number of studies on tuberculosis has increased in these countries (32). The number of publications reported from Brazil and India in our study is remarkable. Also, it is striking that data from Africa, which has about 25% of the world's tuberculosis cases (34), is quite limited. This heterogeneity in the number of studies can be attributed to various factors such as the frequency of anti-TNF use, TB screening status, or lack of data recording.

The Annals of the British Journal of Dermatology is the most productive journal; The University of California System (n=8) from the USA, Icahn School of Medicine

at Mount Sinai (n=6) from the USA and Universidade de São Paulo from Brazil is the most productive institution in terms of psoriasis and TB research. Although psoriatic arthritis and TB are also fields of rheumatology, the number of publications published in rheumatology was lower than expected (8.661%). Adalimumab, etanercept, infliximab, and secukinumab were the most preferred keyword as treatment. It is clear that the increase in the number of publications in recent years is due to the widespread use of anti-TNF. The fact that 112 of 127 articles were published in the last ten years can be associated with the increased use of anti-TNF in this period. It has been reported that data obtained from clinical studies with drugs that inhibit IL-17 and IL-23 cytokines and from post-marketing surveillance do not carry the same risk as anti-TNF in TB reactivation, and this situation should be considered in TB prophylaxis (9,23,24). The follow-up of the number of publications according to the biological agent used in bibliometric analyzes can give a strong idea about this situation.

In conclusion, our bibliometric analysis presents a detailed evaluation of the studies in tuberculosis and psoriasis. This analysis can serve as a benchmark in drawing the attention of researchers worldwide to identify and contribute to the increasing scientific work. Future studies may find bibliometric analysis of the research on TB and psoriasis a useful and practical tool.

Limitations: This research had a few limitations, including the inability to investigate and analyze publications from journals that were not listed in the WOS indexes. Other databases, like Pubmed, Scopus, etc were not included in the study. The analyses were carried out solely with VOSviewer. Additionally, since the keywords were exclusively in English, it is possible that publications written in other languages may have been omitted. There was no content analysis carried out. Future comparison assessments that are more in-depth may be proposed.

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