

# A Bibliometric Analysis of Alopecia Areata Literature over the Past 50 Years

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## ABSTRACT

**Background:** An extensive body of literature has been published regarding alopecia areata (AA) in the past 50 years. The current paper used a bibliometric analysis (BA) to identify high-quality research articles using criteria such as annual citations (ACs) and journal impact factor.

**Objectives:** To identify and analyze the top 100 most cited articles in AA scientific literature over the past 50 years using BA methods.

**Methods:** Web of Science (webOS) citation indexing database was used, on April 4th, 2023, to identify the most cited articles on AA. Articles were ranked by their ACs. Data sets were then subdivided into corresponding and senior authors, year of publication, journal and impact factor, total citations according to webOS database, ACs, affiliation, country of origin, manuscript type, design, focus, and usage count since 2013.

**Results:** The extracted articles were published between 1975-2019. Mean total citations ranged between 67 and 578. The most cited paper was: "Tofacitinib for the treatment of severe alopecia areata and variants: A study of 90 patients" by Liu *et al.* with an AC of 26.5. Most publications were published between 1990 and 1999 (n=28). The Journal of the American Academy of Dermatology was the most published journal (25 articles). The research focus of original papers was treatment (36%), epidemiology (22%), pathogenesis (20%), basic science (16%), and diagnosis (6%).

**Conclusion:** This analysis is the first to provide detailed bibliometric characteristics, highlighting the worldwide burden and research trends in AA literature.

**KEY WORDS:** alopecia areata, literature, bibliometric analysis

## INTRODUCTION

Alopecia areata (AA) is a chronic, immune-mediated inflammatory disease affecting hair follicles (1). It is characterized by well-demarcated round or oval patches of non-scarring hair loss (2). The scalp is the most affected area in approximately 90% of cases. Nail involvement has also been reported (3), most commonly presented as nail pitting. Alopecia areata carries a lifetime risk of up to 1.7%, and men and women are equally affected (4).

The most common age of onset is the third or fourth decade of life, followed by pediatric ages (4,5). In addition, earlier first-onset age is usually associated with an increased lifetime risk for extensive disease. Moreover, about half of childhood AA cases have been associated with other autoimmune disorders (6). Psychiatric comorbidities develop more frequently in patients with AA (5). These comorbidities include anxiety, depression, and social phobia, directly influencing quality of life (7).

Several treatment options have been suggested for AA, including topical, intralesional, and systemic corticosteroids, minoxidil, diphenylcyclopropenone, camouflage, and systemic agents such as methotrexate (10). In addition, current data on the pathophysiology of AA suggested IL-15 production in hair follicles via Janus kinase (JAK)1/2 signaling (11). Subsequently, JAK inhibitors became the new promising treatment of interest (12).

Bibliometric analysis is the attempt to quantitatively assess the academic quality of journals or authors by statistical methods such as citation rates of published articles, thereby presenting knowledge gaps that might predict future research trends. In addition, BA provides important highlights and conclusions for physicians and investigators in a specific field. For example, several areas in dermatology have been investigated via BA, including atopic dermatitis (13,14), psoriasis (15), nail psoriasis (16), psoriatic arthritis (17), melanoma (18), hidradenitis suppurativa (19,20), and rosacea (21). In the current BA, we attempted to identify essential bibliometric characteristics in the top 100 cited AA papers over the last 50 years.

## MATERIALS AND METHODS

### Search strategy

The top 100 most cited articles on AA were retrieved from the Web of Science (webOS) citation indexing database on April 4th, 2023 (22,23). In order to capture the trends and innovations that have occurred over the years, we decided to search via the following strategy: alopecia areata (AA) had to appear in the title, and the results were restricted to the field of dermatology. In addition, the publication period had to be within the past 50 years, with no limitation on language or document type. Raw data and graph analysis were performed in Excel software. Approval from an ethics committee was not required, given that no data collection or intervention in animal or human experiments took place.

### Data extraction and bibliometric parameters

The top 100 most cited articles on AA were extracted to Microsoft Excel 2019. The search results directly led to the retrieval of the title, total citations (TCs) by the webOS database, journal, year of publication, corresponding author, and senior author. Annual citation (AC), the division of TCs by how old the publication is, has been described as a tool to counter the bias arising from older publications having more prominent citations over time (24-26). The manuscript type was defined as an original article, review, letter, or

editorial based on the search results and subsequent checks. The study design and research focus were determined by screening the abstract, available full text, and keywords of the 100 articles. Country and institution were recorded according to information on the corresponding author and senior author for each article. Journal impact factors (IFs) were acquired from the 2021 webOS database. Finally, the webOS usage count since 2013, which shows the number of times users accessed the study via full text since 2013, was extracted directly from the search results.

### Statistical analysis

Statistical analysis was performed in Jasp®. The normality of data was assessed using the Shapiro-Wilk test. Due to the lack of normal data distribution, statistical differences were evaluated using Spearman's rho test for correlations between variables, and the Mann-Whitney U test was used for non-parametric values.

## RESULTS

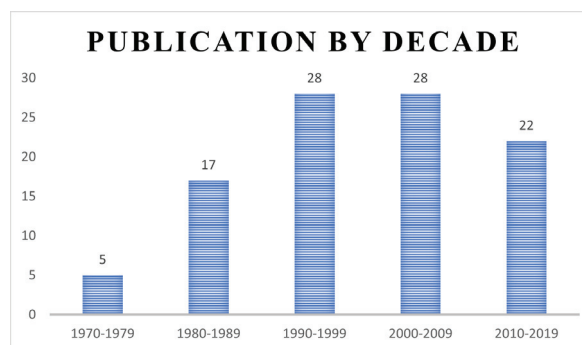
A total of 2,865 studies were retrieved. The top 100 cited articles are listed in Supplementary Table 1 and ranked by ACs. **Supplementary table 1.** available at <https://actadermatovenerologicacroatica.hr>

### Year of publication

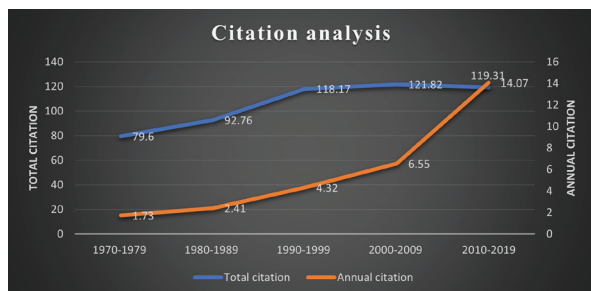
The top 100 cited articles were published between 1975 and 2019. Figure 1 shows the number of articles published in each 10-year interval. The increase in publications began after 1980, with the prior decade accounting for five articles. A peak in article publication occurred between 1990 and 1999 ( $n=28$ ), followed by a decrease between 2010 and 2019 ( $n=22$ ).

### Citations

The TCs of the 100 articles ranged between 67 and 578, with a sum of 11,320. The TC median of was 97

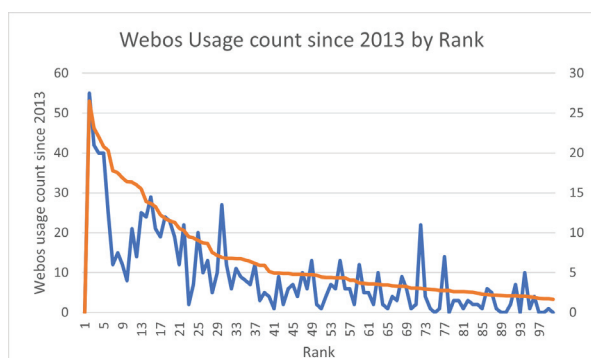


**Figure 1.** Distribution of publications by decade.



**Figure 2.** Citation analysis of the top 100 most cited articles by total and annual citations by decade.

(97, 97). The top 10 most cited articles accounted for 19% ( $n = 2,158$ ) of the TCs. Five of the top 10 ranked articles by highest AC remained in the top 10 according to the TCs. The median AC for articles published between 2010-2019 (13.8 (13.7, 13.0, 9.0)) was substantially higher than the median AC of all the published articles (4.43 (4.41, 4.45)), whereas the median TC for 2010-2019 (103.5 (103.0, 104.0)) was close to that of the whole series (97). Figure 2 shows the citation analysis for the mean ACs and TCs in each 10-year interval. Between 1975 and 1999, there was a strong positive correlation between the ACs and TCs ( $r = 0.75$ ,  $P < 0.001$ ). Between 2000 and 2019, there was a strong positive correlation between the ACs and TCs ( $r = 0.56$ ,  $P < 0.001$ ). Nevertheless, when comparing the ACs and TCs between 1970 and 1999 and in 2000-2019, there was a negative statistical difference ( $r_{\text{rb}} = -0.88$ ,  $P < 0.001$ ) and a non-significant statistical difference, respectively. Furthermore, there was a strong positive correlation between ranking by ACs and webOS usage count since 2013 ( $r = 0.74$ ,  $P < 0.001$ ) (Figure 3).

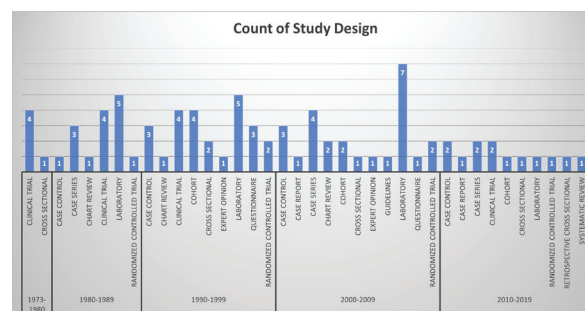


**Figure 3.** The Web of Science usage count since 2013 by publication rank.

### Article design and research focus

Of the 100 most cited articles, 83 were original articles, 14 were reviews, two were letters, and one was an editorial. When comparing the ACs and TCs between original articles and reviews, there was

a strong statistical significant difference ( $r_{\text{rb}} = 0.85$ ,  $P < 0.001$ ) and a non-significant statistical difference, respectively. The mean ACs and TCs were 5.88 and 110.73 for the original articles and 10.98 and 128.1 for the reviews. The 100 most cited articles were then classified into different research focuses: treatment (34%), epidemiology (24%), pathogenesis (20%), basic science (12%), and other (10%). Of the publications focused on treatment, 14 were clinical trials and 6 were randomized controlled trials (RCTs). In addition, there were two meta-analyses and a systematic review focused on the epidemiology of AA, and one systematic review and meta-analysis focused on AA treatment from the past decade. Furthermore, of the articles that focused on treatment for AA, 6% were guidelines, one of which was from the last decade. The original articles were organized according to study design by decade. Out of them, 22% were laboratory ( $n = 18$ ) and 17 % were clinical trials ( $n = 14$ ) (Figure 4). The original articles were then classified into different research focuses: 36% focused on treatment, 22% on epidemiology, 20% on pathogenesis, 16% on basic science, and 6% on diagnosis (Figure 5). Of the original articles that focused on treatment, the research focus was on contact allergens (30%), steroids (13.5%), topical minoxidil (13.5%), and tofacitinib (10%) therapy for AA. Regarding epidemiology, the focus was on AA profile, comorbidities, and mental health as affected by AA.



**Figure 4.** Distribution of study design by decade.

### Countries, institutions, and senior authors

The articles were sorted by country of origin, indicating that the US, the UK, and Germany were the countries that published the most articles on AA, with  $n = 44$ ,  $n = 13$ , and  $n = 12$  articles published, respectively (Figure 6). After controlling for population, these three countries were still those with the greatest number of publications on AA, in the following order: the UK ( $1.92567E-07$ ), Germany ( $1.43937E-07$ ), and the US ( $1.30066E-07$ ). The countries with the greatest number of original articles published are listed in Supplementary Table 2, along with the affli-

**Supplementary Table 2.** The number of publications in the three countries with the most published articles on AA, the affiliated institutions, and senior authors with the largest number of publications, and the respective number of published articles

| Country of Origin        | No. of original articles | Most affiliated institution | No. of articles | Most publishing senior author | No. of articles |
|--------------------------|--------------------------|-----------------------------|-----------------|-------------------------------|-----------------|
| United States of America | 36                       | Jackson Laboratory          | 3               | Sunderg, JP                   | 3               |
|                          |                          | University of Texas         | 3               | Duvic, M                      | 3               |
| United Kingdom           | 12                       | University of Sheffield     | 4               | Bleehen, SS                   | 2               |
| Germany                  | 11                       | University of Munster       | 6               | Happle, R                     | 4               |

ated institutions and senior authors with the largest number of publications and their respective numbers of published articles. Most of the top original articles came from the US (n=36), followed by the UK (n=12) and Germany (n=11).

### Journal of publication

The 100 articles were published in 16 different journals in the field of dermatology (Figure 7). Of these articles, the largest number was published in the Journal of the American Academy of Dermatology (JAAD) (n=25), followed by the Journal of Investigative Dermatology (n=18), the British Journal of Dermatology, and Archives of Dermatology (n=14), and the International Journal of Dermatology (n=7). The IF, which highlights the study's worldwide exposure (Figure 8), suggests that 64% of the studies were published in journals with an IF higher than 7. Further analysis showed that the average IFs of the publications for the decades in the study period were, in descending order, 11.06 (3.645, 15.48), 8.42 (3.204,15.48), 9.26 (3.204,15.48), 8.25 (3.033,15.48), and 4.6 (3.87, 4.789). Supplementary Table 3 lists the five journals in which most AA articles were published, with their IFs.

**Supplementary Table 3.** The number of publications by the five journals with the most articles on AA and the journals' impact factor (2021)

| Journal  | No. of Publications | Impact factor (2021) |
|--|---------------------|----------------------|
| Journal of The American Academy of Dermatology | 25                  | 15.487               |
| Journal of Investigative Dermatology           | 18                  | 7.59                 |
| Archives of Dermatology                        | 14                  | 4.789                |
| British Journal of Dermatology                 | 14                  | 11.113               |
| International Journal of Dermatology           | 7                   | 3.204                |

### Recent articles

No articles published after 2019 were on our list. However, recent articles could indicate future study trends. Therefore, we retrieved the most cited articles published from 2020 to 2023, and the top 10 are listed in Supplementary Table 4. Total citations were between 24 and 62, with a median of 34.5 (32, 37), and the ACs were between 9.33 and 20.66, with a median of 14.83 (14.00, 15.66). When comparing the study period to the recent articles by TCs and ACs, there was a strong positive ( $r_{tb}=1$ ,  $P<0.001$ ) and a strong negative ( $r_{tb}=-0.76$ ,  $P<0.001$ ) statistically significant difference, respectively. Six of the ten recent articles were original articles, three were reviews, and one was a letter. The research focus of the ten articles was treatment (60%), epidemiology (20%), pathogenesis (10%), and basic science (10%). Two articles were RCTs on the efficacy and safety of oral Janus kinase inhibitors in AA, published in 2021.

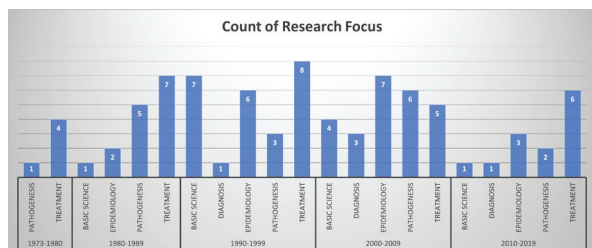
### DISCUSSION

In the current BA, we analyzed the central insights and the main features of research trends regarding AA in the study period. The article with the highest number of ACs, "Tofacitinib For The Treatment of Severe Alopecia Areata And Variants: A Study of 90 Patients", (12) emphasized the growing interest in finding a permanent or successive treatment for AA. This article showed that tofacitinib 5 mg BID (JAK inhibitors) produced hair regrowth in severe AA, alopecia totalis, and alopecia universalis and achieved a clinical response in 77% of patients. In addition, it also highlighted the combined successful use of tofacitinib with pulsed prednisone in patients who were not demonstrating significant regrowth with tofacitinib monotherapy. The article entitled "Depression And Suicidal Ideation In Dermatology Patients With Acne, Alopecia Areata, Atopic Dermatitis And Psoriasis" (27) had the highest TCs (of 571) and the 2<sup>nd</sup> highest ACs among the top 100 articles. This article indicated an increased prevalence of psychiatric disorders among individuals with dermatological conditions such as

**Supplementary Table 4.** The top 10 most cited recent articles on alopecia areata

| Rank | Title   | Year of publication | Journal  | IF (2021) | TC | AC     | Country of origin        | Type of Study | Study design                | Research focus |
|------|---|---------------------|--|-----------|----|--------|--------------------------|---------------|-----------------------------|----------------|
| 1    | Hair Follicle Immune Privilege and Its Collapse In Alopecia Areata  | 2020                | Experimental Dermatology                                       | 4.511     | 62 | 20.667 | Germany                  | Review        | Review                      | Basic science  |
| 2    | Epidemiology Of Alopecia Areata, Ophiasis, Totalis, And Universalis: A Systematic Review And Meta-Analysis  | 2020                | Journal Of the American Academy Of Dermatology                 | 15.487    | 62 | 20.667 | United States of America | Review        | Meta analysis               | Epidemiology   |
| 3    | A phase 2a randomized, placebo-controlled study to evaluate the efficacy and safety of the oral Janus kinase inhibitors ritlecitinib and brepocitinib in alopecia areata: 24-week results | 2021                | Journal Of the American Academy Of Dermatology                 | 15.487    | 40 | 20     | United States of America | Article       | Randomized controlled trial | Treatment      |
| 4    | Efficacy and safety of the oral Janus kinase inhibitor baricitinib in the treatment of adults with alopecia areata: Phase 2 results from a randomized controlled study                    | 2021                | Journal Of the American Academy Of Dermatology                 | 15.487    | 32 | 16     | United States of America | Article       | Randomized controlled trial | Treatment      |
| 5    | The Alopecia Areata Consensus Of Experts (Ace) Study: Results Of An International Expert Opinion On Treatments For Alopecia Areata  | 2020                | Journal Of the American Academy Of Dermatology                 | 15.487    | 47 | 15.667 | Australia                | Article       | Expert opinion              | Treatment      |
| 6    | Psychosocial and psychiatric comorbidities and health-related quality of life in alopecia areata: A systematic review   | 2021                | Journal Of the American Academy Of Dermatology                 | 15.487    | 28 | 14     | United States of America | Review        | Systematic review           | Epidemiology   |
| 7    | Analysis of the gut microbiota in alopecia areata: identification of bacterial biomarkers   | 2020                | Journal of The European Academy of Dermatology and Venereology | 9.228     | 37 | 12.333 | Spain                    | Article       | Cross sectional             | Basic science  |
| 8    | Cross-sectional study of blood biomarkers of patients with moderate to severe alopecia areata reveals systemic immune and cardiovascular biomarker dysregulation                          | 2021                | Journal Of the American Academy Of Dermatology                 | 15.487    | 24 | 12     | United States of America | Article       | Cross sectional             | Basic science  |
| 9    | Short-term stress-related increasing cases of alopecia areata during the COVID-19 pandemic  | 2020                | Journal of Dermatological Treatment                            | 3.23      | 29 | 9.6667 | Turkey                   | Letter        | Cross sectional             | Epidemiology   |
| 10   | Bidirectional association between alopecia areata and major depressive disorder among probands and unaffected siblings: A nationwide population-based study                               | 2020                | Journal Of the American Academy Of Dermatology                 | 15.487    | 28 | 9.3333 | Taiwan                   | Article       | Cohort                      | Epidemiology   |





**Figure 5.** Distribution of original articles with a research focus by decade.

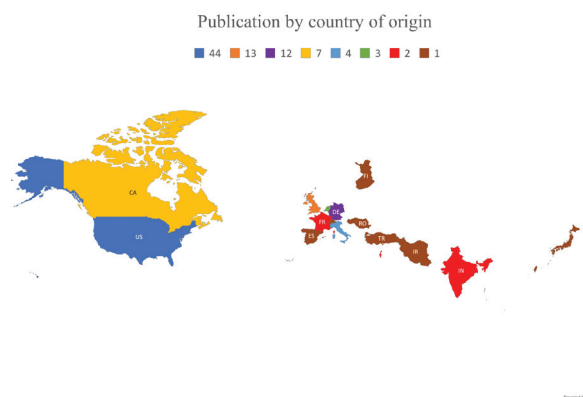
acne, psoriasis, atopic dermatitis, and AA. Although it revealed no suicidal ideation and less depression in patients with AA compared with other skin disorders, it is now well-established that AA is associated with an increased prevalence of psychiatric and anxiety disorders (28).

The greatest number of articles published in a single interval was between 1990 and 1999 (Figure 1), a finding that might be explained by emerging research techniques and focuses such as laboratory and basic science, which were surging in that decade (Figure 4). The article "Alopecia Areata Investigational Assessment Guidelines" (29), published at the end of that decade (1999), defined and categorized AA and may have contributed to the high number of publications ( $n=28$ ) published in the following decade (i.e., between 2000 and 2009). This phenomenon can perhaps be attributed to guidelines aiming to assess subjects for clinical and laboratory studies, mainly increasing the surge of publications regarding the focus of epidemiology research, as seen in our BA.

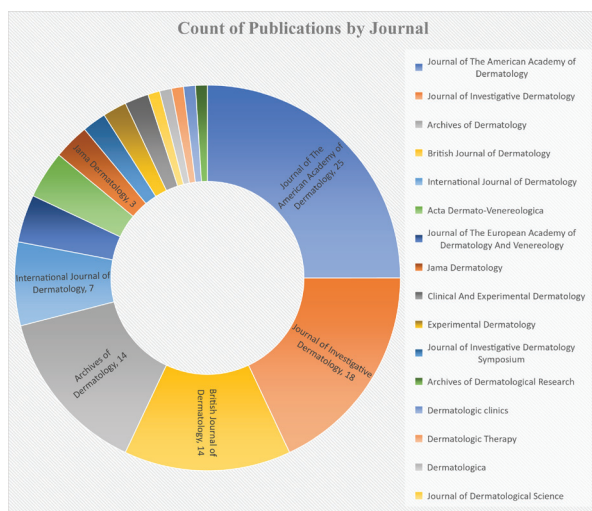
10-year interval citation analysis showed an increase in TCs between 1970 and 1999, with a plateau until 2019, while ACs moderately increased between 1970 and 2009, with a sharp ascent until 2019 (Figure 2). The latter finding could be attributed to an emerging treatment, JAK inhibitors, in the AA field. In our analysis, out of the top 10 most cited articles, eight were published between 2010 and 2019, and three articles focused on JAK inhibitors as a treatment for AA (two on tofacitinib and one meta-analysis on JAK inhibitors), revealing a recent interest in these new treatments with increased popularity. Furthermore, a strong positive correlation was found between ranking by ACs and webOS usage count since 2013 (Figure 3), supporting our decision to rank this BA according to ACs to counter the bias of older papers having a greater chance of being cited (30).

With regard to other dermatological BA, the median TC for melanoma was 526 (18), and the median TC for psoriatic arthritis was 265.9 (17) bibliometric method that analyzes the frequency and pattern of citations in any given scientific discipline. Over

the last two decades, the study of psoriatic arthritis has undergone substantial progress, which has enhanced our ability to assess and treat the disease, and yet an updated citation analysis that reflects these advances is lacking. **OBJECTIVE:** To highlight the scientific progress in psoriatic arthritis by identifying and analyzing the 100 top-cited psoriatic arthritis articles from the last 40 years. **METHODS:** Publications on psoriatic arthritis were identified using the Scopus citation database and Web of Science. No date range limits were applied. Data on the 100 top-cited publications were extracted and analyzed. **RESULTS:** Of the 100 top-cited publications, the median number of citations per publication was 265.9. Articles originated from 29 different countries. Publication dates ranged from 1973 to 2014. The majority ( $n = 88$ ). The significantly lower median citation for AA of 95 may be attributed to the fact that AA research is still ongoing, mainly concerning pathogenesis and treatment modalities, and will be a growing field in further research, given that there is still no definite or permanent treatment for AA. Out of the most highly cited original articles, the main research focuses were treatment (36%) and epidemiology (22%) (Figure 5). Figure 5 shows the steady and high interest in treatment research throughout all of the decades in the study period, emphasizing the need to investigate different treatment modalities for AA. A total of six RCT articles were among the most highly cited articles, all with a treatment research focus, comparing different treatment modalities such as pulse prednisolone, topical corticosteroids, aromatherapy, and topical minoxidil. The transition in focus from these modalities towards interest in novel treatment can be seen in our analysis of recent articles, with two RCTs from 2021 (Supplementary Table 4) and one meta-analysis from 2019 (Supplementary Table 1) focusing on Janus kinase inhibitors for the treatment of AA. Only four meta-analyses were conducted; one was from recent articles (Supplementary Table 4) concerning epidemiology,



**Figure 6.** Distribution of publications by country of origin.



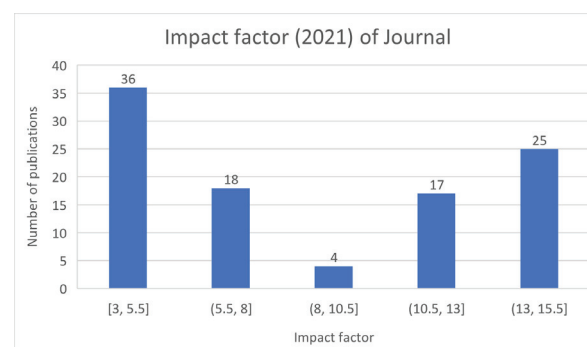
**Figure 7.** Distribution of publication by journals that published the most articles on AA.

thus highlighting the demand for big data analytics in order to provide better understanding of AA.

The epidemiology of AA ranked second behind the treatment research focus. The prevalence of AA is approximately 2%, with regional variability (North America with a higher prevalence, 2.47%, compared with Europe, 0.58%) (4), with a significantly increased prevalence over time. The latter finding may be explained by a detection bias due to improved disease awareness and evaluation (investigation assessment (1)) of AA over time. In addition, AA was found to be more common in children/adolescents (4), and the onset of AA in the first two decades of life was more often associated with severe alopecia (5). However, only five articles out of the top 100 concerned the pediatric population. Two confirmed a worse prognosis in children (32 treatments, and disease course. RESULTS: Severity of AA at first consultation ranged from mild (128 patients, 33 Japan and European countries, but there is a paucity of literature on AA from Asian countries, especially from the Indian subcontinent. METHODS: In a prospective, hospital-based study lasting for a decade (1983-1992), and one described psychosomatic factors related to a worse prognosis in childhood (34 with special reference to possible associations, aetiological factors and the relevance of additional investigations. The patients were divided into two groups: (I). Only one article mentioned associated comorbidities such as atopic dermatitis and lupus erythematosus in AA in children younger than ten years and other diseases such as psoriasis and rheumatoid arthritis at the onset age of 11 to 20 years (35). An additional article highlighted tofacitinib as a promising treatment in adolescence (36). There is a gap in the literature concerning the pediatric popu-

lation, mainly regarding treatment options. Another aspect of the AA disease burden are the associated psychiatric disorders, primarily depression and anxiety (5,37). Eight percent of the top 100 articles were related to the psychosocial aspect of AA. This finding is likely related to the fact that patients with AA experience significant impairments in health-related quality of life, especially in mental health (7), with en suffering from higher rates of depression (38 nons-carring hair loss. There is a paucity of clinical data in Asians. OBJECTIVE: To study the epidemiology, clinical aspects, associations, and treatment of alopecia areata in an Asian population over a 1-year period. METHODS: Records of all newly diagnosed alopecia areata cases seen from May 1998 to April 1999 at the National Skin Center were collated with regard to the epidemiology, pattern of alopecia, and associations according to the investigational guidelines published by Oslen *et al.* The treatment and psychologic impact of alopecia areata were also assessed. RESULTS: Two hundred and nineteen new case referrals of alopecia areata were seen from May 1998 to April 1999. The incidence of alopecia areata was 3.8%. There were 173 Chinese (79%). In addition, stress plays an essential role in the onset and aggravation of AA (39).

Our analysis indicated that most of the top cited articles sorted by country of origin after controlling for the population were the UK, Germany, and the US (Figure 6). This finding may be attributed to the global burden of AA reported in those countries. Most of the top cited articles were published in the Journal of the American Academy of Dermatology, followed by the Journal of Investigative Dermatology, the British Journal of Dermatology, Archives of Dermatology, and the International Journal of Dermatology (Figure 7). This finding may be attributed to the countries in which these journals are published and the high quality of articles in these journals. In addition, the highest average IF throughout the years was from the most recent decades (10.88), contributing to the trend that researchers are more likely to select high-impact factor journals for citations.



**Figure 8.** Distribution by journal impact factor.

We identified 77 corresponding authors from 20 countries in the top 100 cited papers. Happle, of the University of Munster in Germany, was the senior author who published the greatest number of original articles. To date, only one scientometric analysis of AA exists. In contrast to our analysis, which covers the 100 most cited articles in the past 50 years that were confined to AA appearing in the title and to the field of dermatology alone, the prior paper is limited to 2010-2019 with no criteria regarding the article title or field, and thus could not present the trends and features included above (40).

The current study had several limitations. First, our citation analysis did not exclude the influence of self-citation, indicating that citation ranking does not always measure quality but rather attention to a specific topic and degree of recognition. Second, as Garfield *et al.* explained, older articles have a greater chance of being cited, and even the most cited papers have no citations when just published (30). Thus, the TC number is influenced by the time of the article's publication. Our analysis attempted to counter this bias by ranking the articles according to AC.

## CONCLUSION

Our study provided a detailed BA of the top 100 cited articles related to AA in the field of dermatology. In addition, it highlighted research and knowledge gaps such as new treatment modalities, psychosocial burden, and pediatric population-related AA.

## Abbreviations

AA – Alopecia areata

AC – Annual citation

BA – Bibliometric analysis

JAK – Janus kinase

IF – Impact factor

RCT – Randomized controlled trial

TC – Total citations

US – United States

UK – United Kingdom

webOS – Web of Science

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