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ORIGINAL ARTICLE

Top 100 cited articles on fibromyalgia syndrome: A bibliometric and altmetric analyses study

Fibromyalji sendromunda atıf alan top 100 makale: Bir bibliyometrik ve altmetrik analiz çalışması

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Summary

Objectives: Fibromyalgia syndrome is a global health problem. The aim of this study was to analyze the top 100 cited articles.

Methods: Web of Science database was scanned for the period between 1990 and 2020 using the search term, "fibromyalgia," and the 100 most cited articles were determined. For the bibliometric analysis, a record was made of the article title, year of publication, number of authors and names, number of citations, citation index, name of the journal in which it was published, impact factor, type of article, and source of funding. The altmetric attention score was recorded from the automatic software calculation.

Results: The total number of citations of the articles in the top 100 list varied between 203 and 6254. The majority of articles were published in arthritis and rheumatism (n=24) and pain (n=15) journals. The country producing the most articles was the US and the most cited author was Russel IJ. Case–controlled studies constituted the largest part of the top 100 (n=36). When the number of citations was examined, studies evaluating classification criteria, diagnostic criteria, and epidemiologic study were at the forefront. In terms of altmetric attention score, treatment studies, especially exercise, were in the first orders.

Conclusion: This study presents a view on the subject of the level of interest shown by the scientific world and on social platforms to the most cited articles on the subject of fibromyalgia. There is a need for further studies which would use more wide-scale databases and offer interactions between countries.

Keywords: Altmetric analysis; bibliometric analysis; citation; fibromyalgia.

Özet

Amaç: Fibromiyalji sendromu küresel bir sağlık sorunudur. Bu çalışmanın amacı atıf yapılan top 100 makaleyi analiz etmektir.

Gereç ve Yöntem: Fibromyalji kelimesi kullanılarak, Web of Science'de 1990 ve 2020 yılları arasında en çok atıf alan top 100 makale belirlendi. Bibliyometrik analiz için makale başlığı, yazar sayıları ve isimleri, atıf indeksi, dergilerin isimleri, etki faktörleri, makalelerin türleri ve fon kaynkaları belirlendi. Otomatik olarak hesap yapan bir yazılımla altmetrik skor kaydedildi.

Bulgular: Top 100 listesinde total atıf sayısı 203 ile 6254 arasındaydı. Makalelerin büyük çoğunluğu Arthritis and Rheumatism (n=24) ve Pain (n=15) dergilerinde yayınlanmıştı. En çok makale üreten ülke Amerika idi ve en çok atıf alan yazar Russel IJ idi. Vaka-Kontrollu çalışmalar top 100 makalelerin büyük kısmını oluşturuyordu (n=36). Klasifikasyon kriterleri, diagnostik kriterler ile ilgili çalışmalar ve epidemiyolojik çalışmalar en çok atıf alan makalelerde ön plana çıkan konulardı. Altmetrik skor yönüyle özellikle egzersiz konusu olmak üzere tedaviye yönelik çalışmalar ön plandaydı.

Sonuç: Bu çalışma, bilim dünyasının ve sosyal medya platformlarının fibromiyalji konusunda en çok atıfta bulunulan makalelere gösterdiği ilgi düzeyine bir bakış sunmaktadır. Ülkeler arasında etkileşimler sunan, daha geniş veri tabanları kullanan ileri çalışmalara ihtiyaç vardır.

Anahtar sözcükler: Altmetrik analiz; bibliyometrik analiz; atıf; fibromyalji

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Introduction

Fibromyalgia syndrome (FMS) is a chronic pain syndrome, characterized by diffuse pain and tenderness of the joints, muscles, tendons, enthesis points, and accompanied by several symptoms such as sleep disturbance, morning stiffness, fatigue, bowel problems, and multiple somatic and cognitive problems; its annual prevalence is 2–4% and it is more common among individuals between 25 and 55 years of age and women; its severity increases with age.[1,2] Although the etiopathogenesis of FMS cannot be fully explained, it is a multifactorial condition, involving genetic and environmental factors.[3] Medical treatments, physical therapy modalities, various exercise approaches including aerobic exercises, cognitive and behavioral therapies, and multidisciplinary approaches that target the symptoms of the patients are recommended for its treatment.[4–6] From this viewpoint, FMS is a popular topic that the pathologies of the musculoskeletal system still need explore although innovations related to it are continuously presented in the literature and its diagnostic and treatment criteria are timely updated.

Bibliometric studies examine the accumulated scientific data on a specific subject and evaluate its scientific performance.[7] They thus provide a close follow-up of the existing literature and guide the future related studies. With this method, all micro- and macro-publication models are evaluated quantitatively through mathematical and statistical calculations. Therefore, the subject is evaluated by considering/understanding the bigger picture or with a bird's eye perspective. In 1969, Prichard used this term for the 1st time in the literature, but the term gained popularity only after 1980 – thanks to its perspective.[8] In the literature, bibliometric analysis was employed extensively for analyzing several diseases belonging to different medical branches.

The criteria that researchers often consider for searching high-quality articles on a particular subject include the number of citations of the journal, impact factor, and h-index.[9] These criteria provide information based on the scientific data of relevant articles. Moreover, emerging social media platforms have also begun to participate in the promotion of medical literature. Thus, altmetrics are employed to determine the metrics of a particular article on such platforms; it also evaluates the parameters of scientific research with respect to bureaucracy, a country's health management, and the public and determines the number of citations, impact factor, and h-index.[10,11] By measuring the web quotations and number of social media views and interactions on platforms such as Facebook, Twitter, and LinkedIn and blogs, altmetrics provide quantitative data.[12] Over the past few years, dissemination of medical literature through social media platforms has increased. It is planned to analyze the topmost cited 100 (T100) articles on FMS between 1990 and 2020 by employing the above-mentioned techniques and evaluate the relationship between the total number of citations/citation index and the altmetric attention score in this study. Thus, through data such as popular issues or shortcomings in this field, it is aimed to contribute to the process of determining the hypotheses and methodologies of new studies.

Material and Methods

Study design and search strategy

The Web of Science database (Clarivate, Analytics, Philadelphia, US), which determines the citation index of an article to assess its academic significance in a particular discipline, was used to identify the T100 articles on FMS (http://apps.webofknowledge.com). On June 9, 2020, using the key word "fibromyalgia," a search was performed in the Web of Science database for articles published in English between 1990 and 2020. Subsequently, using the "Times cited" option, the articles were arranged on the basis of the highest to lowest number of citations.[13] No ethical committee approval was required because the data used in this study were obtained from the published articles.

Article selection

T100 articles were determined from a search on the WOS database screening the abstracts/complete texts based on study type and subject by two reviewers (FB and EİY) independently. Publication types were limited to original articles and reviews. The letter, editorial material, correction, and other publication types were excluded from the study. Only articles of which main focus was FMS were included in the study. Although they contain in-

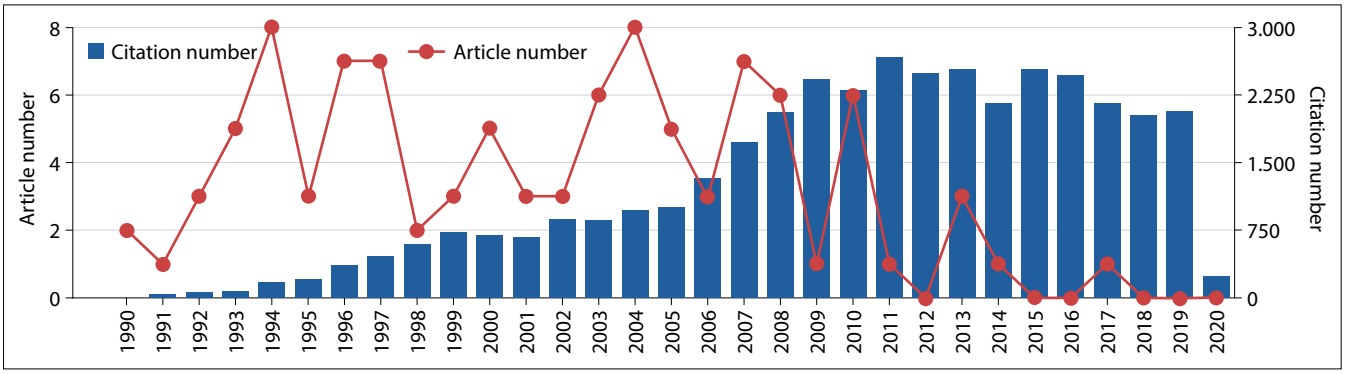

Figure 1. Number of citations and articles according to years.

formation on fibromyalgia, articles with main topics other than FMS were excluded from the study. When there were disagreements on these issues between two reviewers, a third reviewer (HÇY) helped to achieve consensus.

Data extraction

In the bibliometric analysis, the title of the article, year of publication, number of authors, author names (first authors and corresponding authors) and their countries, number of citations, citation index, type, subject and sources of funding, name of the publication, Q classification, h-index, and impact factor were recorded. When the authors were not from the same country, the country of the corresponding author was considered as the country of the article.[14] The citation index is a parameter obtained by calculating the number of citations on a yearly basis. It is determined by the ratio of the total number of citations of the article to the number of years since its publication.[7]

"Altmetric attention score," was obtained through the "Altmetric it" function available on the website Altmetric.com (https://www.altmetric.com). It evaluates the impact of an article by considering its number of views and downloads on the social platforms in addition to its number of citations. It is determined by three main factors, namely, volume, sources, and authors. The more an article is cited by different authors, the higher is the altmetric attention score.[15] Diverse sources of citation (newspapers, Facebook, Twitter, etc.) contribute to the score at different levels. In addition, the characteristics of the citing authors are also decisive in the altmetric attention score calculation. Details regarding the calculation method can be found on the above-mentioned website.

Statistical analysis

We used the IBM SPSS Statistics v. 21.0 statistical software (Armonk, NY, USA) to perform all statistical analyses. We used the Shapiro–Wilk test to determine the variable distribution. Descriptive statistics were indicated as "mean±standard deviation" and "median, minimum–maximum" for quantitative variables, whereas "frequency and percentage (n [%])" were indicated for categorical variables. We employed the Spearman's rank correlation analysis to assess the correlations among non-normal distributing variables. The relations were interpreted as highly correlated when r was ≥0.60, moderately correlated when r was between 0.30 and 0.60, and poorly correlated when r was ≤0.30.[16] Moreover, $p<0.05$ was considered statistically significant for this study.

Results

The search conducted in the Web of Science database using the key word "fibromyalgia" produced a total of 16,971 articles published between 1990 and 2020. The T20 articles with the highest citations are presented in Table 1. The total number of citations ranged between 203 and 6254 (#1 and #100 in supplement material).[17,18] The mean citation number was 390.82±638.36, and the median citation value was 258.5. The total number of citations and articles published by years is presented in Figure 1. The altmetric attention score ranged between 1 and 245 (#11 and #79 in supplement material). The altmetric attention score could not be calculated for 35 articles. The mean altmetric attention score was 16.68±56.39, and the median value was 3. The most cited article in T100 (#1) was "The American College of Rheumatology 1990 Criteria for the Classification of Fibromyalgia – Report of the Multicenter Criteria Committee," published by Wolfe et al.[17] in 1990; this article also had the highest citation

Table 1. General information related to the top 100 cited (Top 20) articles on fibromyalgia (sorted by total citations)

No.	Title	Authors	CA	Source title	PY	TC	AS	CI	NA	AT
1	The American College of Rheumatology 1990 criteria for the classification of fibromyalgia - Report of the multicenter criteria committee	Wolfe et al.	Wolfe	Arthritis & Rheumatology	1990	6254	85	201.74	24	1
2	The American College of Rheumatology preliminary diagnostic criteria for fibromyalgia and measurement of symptom severity	Wolfe et al.	Wolfe	Arthritis Care & Research	2010	1736	57	157.82	10	1
3	The prevalence and characteristics of fibromyalgia in the general population	Wolfe et al.	Wolfe	Arthritis & Rheumatology	1995	1621	20	62.35	5	2
4	The Fibromyalgia Impact Questionnaire - development and validation	Burckhardt et al.	Burckhardt	Journal of Rheumatology	1991	1292	3	43.07	3	2
5	Functional magnetic resonance imaging evidence of augmented pain processing in fibromyalgia	Gracely et al.	Clauw	Arthritis & Rheumatology	2002	761	17	40.05	4	2
6	Fibromyalgia criteria and severity scales for clinical and epidemiological studies: A modification of the ACR preliminary diagnostic criteria for fibromyalgia	Wolfe et al.	Wolfe	Journal of Rheumatology	2011	587	18	58.7	10	1
7	Pain catastrophizing and neural responses to pain among persons with fibromyalgia	Gracely et al.	Clauw	Brain	2004	518	45	30.47	7	2
8	Management of fibromyalgia syndrome	Goldenberg et al.	Goldenberg	Jama-Journal of the American Medical Association	2004	504	11	29.65	3	3
9	An internet survey of 2,596 people with fibromyalgia	Bennett et al.	Bennett	Bmc Musculoskeletal Disorders	2007	499	19	35.64	5	2
10	EULAR evidence-based recommendations for the management of fibromyalgia syndrome	Carville et al.	Carville	Annals of the Rheumatic Diseases	2008	483	14	37.15	20	3
11	Fibromyalgia a clinical review	Clauw et al.	Clauw	Jama-Journal of the American Medical Association	2014	476	245	68	1	3
12	Abnormal sensitization and temporal summation of second pain (wind-up) in patients with fibromyalgia syndrome	Staud et al.	Staud	Pain	2001	476	3	23.8	5	2

Table 1 (cont.). General information related to the top 100 cited (Top 20) articles on fibromyalgia (sorted by total citations)

No.	Title	Authors	CA	Source title	PY	TC	AS	CI	NA	AT
13	Elevated cerebrospinal fluid levels of substance-P in patients with the fibromyalgia syndrome	Russell et al.	Russell	Arthritis & Rheumatology	1994	442	14	16.37	8	2
14	Pregabalin for the treatment of fibromyalgia syndrome - Results of a randomized, double-blind, placebo-controlled trial	Crofford et al.	Crofford	Arthritis & Rheumatology	2005	417	9	26.06	10	2
15	A double-blind, multicenter trial comparing duloxetine with placebo in the treatment of fibromyalgia patients with or without major depressive disorder	Arnold et al.	Arnold	Arthritis & Rheumatology	2004	409	11	24.06	7	2
16	Hypothalamic-pituitary-adrenal axis perturbations in patients with fibromyalgia	Crofford et al.	Crofford	Arthritis & Rheumatology	1994	401	0	14.85	10	2
17	The Fibromyalgia Impact Questionnaire (FIQ): a review of its development, current version, operating characteristics and uses	Bennett et al.	Bennett	Clinical and Experimental Rheumatology	2005	395	0	24.69	1	3
18	Comorbidity of fibromyalgia with medical and psychiatric disorders	Hudson et al.	Hudson	American Journal of Medicine	1992	391	3	13.48	5	2
19	Possible deficiencies of pain modulation in fibromyalgia	Lautenbacher et al.	Lautenbacher	Clinical Journal of Pain	1997	379	3	15.79	2	2
20	Prevalence of fibromyalgia: A survey in five European countries	Branco et al.	Branco	Seminars in Arthritis and Rheumatism	2010	378	3	34.36	13	2

CA: Corresponding author; ST: Source title; PY: Publication year; TC: Total citations; AS: Altmetric score; CI: Citation index; NA: Number of authors; AT: Article type; Article type: 1; Clinical guideline, 2; Clinical study, 3; Review, 4; Meta-analysis, 5; Editorial.

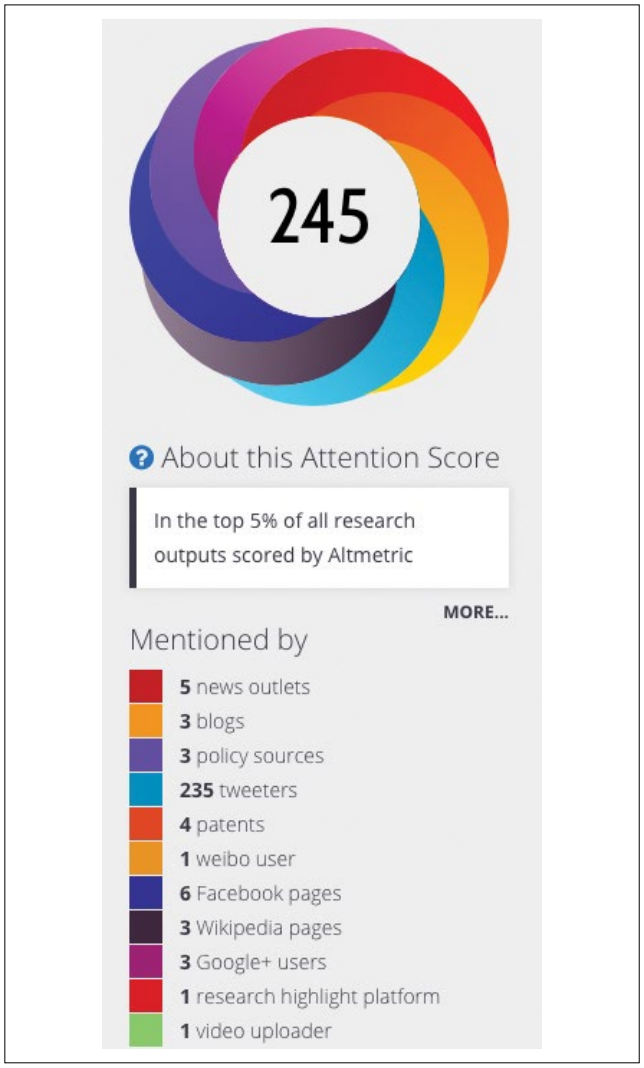

Figure 2. An altmetric donut representing different social media sources of interest (11th article in the T100 list).

index. The highest altmetric attention score (#11) was obtained for "Fibromyalgia: A Clinical Review," published by Clauw et al.[3] in 2014 (Fig. 2).

The studies that examined classifications, diagnostic criteria, and epidemiological parameters were at the forefront with respect to the number of citations.[17,19,20] In terms of altmetric attention score, a clinical review, a guide containing treatment recommendations, and a study evaluating the effectiveness of Tai Chi exercises in FMS treatment were at the top lines of the list.[3,5,21] The most commonly evaluated topics in T100 articles were etiopathogenesis (n=30), treatment (n=18), and epidemiology (n=15). Moderate correlation was detected between the citation index and the altmetric attention score ($p<0.05$, $r=0.429$) (Fig. 3). The correlation between the total number of citations and the altmetric attention score was weak ($p<0.05$, $r=0.195$) (Fig. 3).

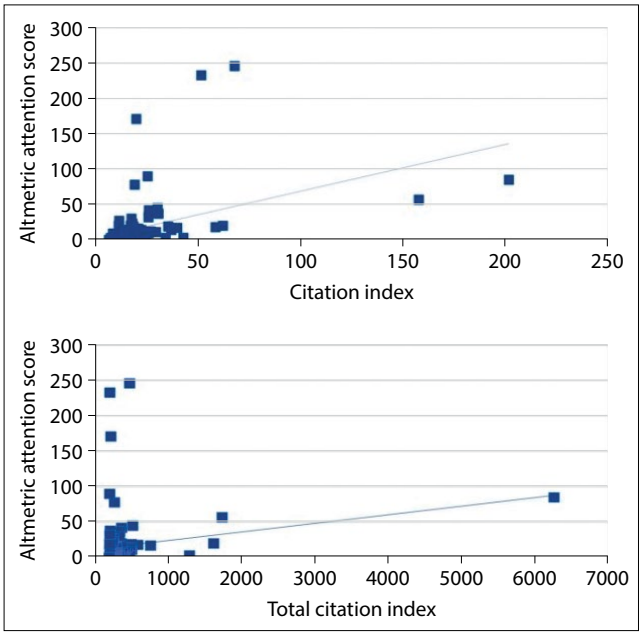

Figure 3. Scatter plot charts between altmetric attention score, and citation index, altmetric attention score, and total citation score.

Table 2. Journals of the T100 articles (n≥2)

Journal	Number of articles
Arthritis and rheumatology	24
Pain	15
Journal of Rheumatology	12
Seminars in arthritis and rheumatism	4
Annals of the rheumatic diseases	3
American Journal of Medicine	2
Arthritis research and therapy	2
Archives of internal medicine	2
European Journal of Pain	2
Brain	2
The Journal of the American Medical Association	2
Journal of Neuroscience	2
Psychosomatic medicine	2
Psychosomatics	2
Scandinavian Journal of Rheumatology	2

The most cited articles on FMS were published mainly in 1994 (n=8) and 2004 (n=8) (Fig. 1). No article published after 2017 could make into the T100 list. The T100 articles were published in 34 journals. In all, two and more articles were published in 14 journals (Table 2). Most articles were published in arthritis and rheumatism (n=24), pain (n=15), and Journal of Rheumatology (n=12) (Table 2). Q classification, h-

Table 3. Journals with T100 articles, ranked according to times cited

Journal name	Number of articles	IF*	Q category**	H index**
Arthritis and Rheumatology	24	9.002	1	290
Pain	15	6.029	1	238
Journal of Rheumatology	12	3.63	1	165
Seminars in Arthritis and Rheumatism	4	5.072	1	102
Arthritis Care and Research	4	4.53	1	141
Annals of the Rheumatic Diseases	3	14.29	1	212
American Journal of Medicine	2	4.760	1	212
Archives of Internal Medicine	2	20.768	1	313
Arthritis Research Therapy	2	4.148	1	132
Brain	2	11.814	1	308
European Journal of Pain	2	3.188	1	96
The Journal of the American Medical Association	2	51.273	1	622
Journal of Neuroscience	2	6.074	1	422
Psychosomatic Medicine	2	3.937	1	171
Psychosomatics	2	1.541	2	89
Scandinavian Journal of Rheumatology	2	2.706	1	72
Annals of Behavioral	1	3.575	1	118
Best Practice and Research: Clinical Rheumatology	1	3.016	1	89
Bmc Musculoskeletal Disorder	1	4.5	2	81
British Medical Journal	1	27.604	1	392
Clinical And Experimental Rheumatology	1	3.238	1	87
Clinical Rheumatology	1	2.293	1	74
Clinical Journal of Pain	1	2.893	1	116
Current Pain and Headache Reports	1	2.767	1	55
Annals of Behavioral Medicine	1	3.575	1	118
Human Reproduction	1	5.506	1	209
New England Journal of Medicine	1	70.67	1	933
Qualitative Health Research	1	3.030	1	95
General Hospital Psychiatry	1	3.220	1	94
Rheumatology	1	5.149	1	156
Patient Education and Counseling	1	2.821	1	119
Psychotherapy and Psychosomatics	1	13.744	1	86
Journal of General Internal Medicine	1	4.606	1	161
European Journal of Neuroscience	1	2.832	1	191

*IF: Impact factor; 2018 Journal Citation Reports, Web of Science Group, ** 2020 SCImago Journal and Country Rank.

index, and IF (impact factor) data of the journals in which the T100 articles were published are presented in Table 3. The majority of the articles in the T100 were clinical studies (n=80), and about half of them were case–control studies (n=36) (Fig. 4).

The countries with the highest contributions to the T100 articles were the USA (n=64), Canada (n=13), and Germany (n=13). The number of authors of the T100 articles ranged between 1 and 24. On the contrary, the majority of the articles (n=55) were written by ≥5 authors. The most frequent authors were Russel I. J., Goldenberg D. L., and Wolfe F. Russel I. J. was also the most quoted author (with a total citation number of 12,863); he served as the first and corresponding author in two articles each and contributed to 12 articles in total.

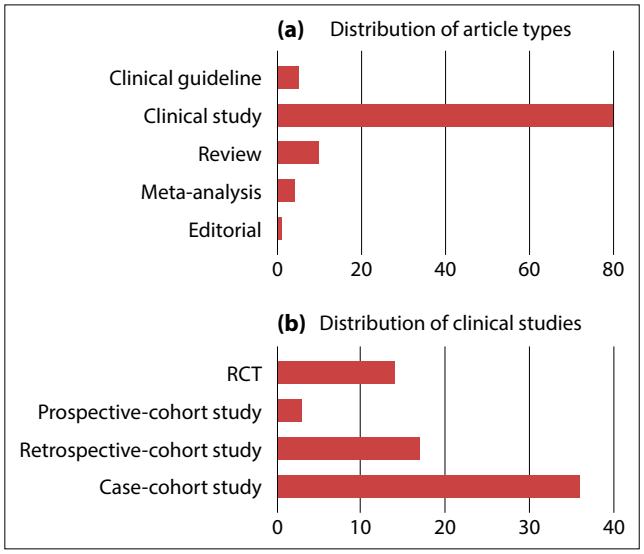

Figure 4. (a) Distribution of article type. **(b)** Distribution of clinical study.

Moreover, public institutions supported 27 of the T100 articles, and 3 articles were funded by medical companies; other 3 were supported by both these sources.

Discussion

Bibliometric analysis determines scientific performance by evaluating the articles published in a specific time interval and the relationships between these articles quantitatively.[22] Moreover, altmetric analysis could be used as an alternative to impact factor and similar evaluation methods, and considering the fact that due to the widespread use of social media, only references made from web-based journals cannot be regarded as a stand-alone criterion as an influence factor.[23] Altmetrics evaluate the number of citations and the number of views and downloads of articles and their impact on social media. For this purpose, references made on social media platforms such as Twitter, Facebook, and Google+ are considered.[24] Numerous bibliometric studies were conducted on various medical subjects in the literature, whereas fewer studies including altmetrics analysis emerged only in recent years.[7,9,14] No study including both bibliometric and altmetric analyses related to FMS was found in the literature research. In this study, the T100 articles on FMS with the highest number of citations were examined using these techniques.

Analysis of the citations to articles is one of the most important aspects of bibliometric assessments. In this study, the article in which the classification criteria of FMS were defined was found to be the article with the highest citations and citation index.[17] The article with the second highest number of citations and citation index was a study that defined the diagnostic criteria.[19] FMS is a clinical diagnosis, but some criteria have been introduced to establish common grounds. Classification criteria were defined in 1990, and they were revised in 2010 by eliminating the tender point count and adding severity survey of painful areas and the most common symptoms and findings of FMS. New criteria were published as diagnostic criteria. These two articles, which contain basic information that can be used in the design of clinical trials on FMS, are considered to have the highest number of citations and citation index.

The article with the highest altmetric attention score was a comprehensive review of clinical characteristics of FMS.[3] The studies that focused on the European League Against Rheumatism treatment recommendations in the treatment of FMS and the effectiveness of Tai Chi exercises secured the second and third places, respectively.[5,21] The first two most cited articles were also at the top of the altmetric attention score ranking (5th and 7th), while the articles with the highest altmetric attention ranking were not the most cited articles. The first two articles with the highest altmetric attention score ranked 11th and 93rd in the citation count ranking. These findings also markedly highlight the difference between bibliometric and altmetric analyses.

The T100 list covered the studies on subjects such as diagnostic criteria, symptom severity scales, effectiveness of medical treatment and other treatment approaches, etiopathogenesis, and radiological assessments in FMS. Particularly, the studies in which etiopathogenesis was evaluated stood out (n=30). In these studies, the role of the abnormal peripheral and central pain mechanisms or both, along with genetic factors, was stressed in the development of common and chronic pain experienced by patients with fibromyalgia.[25–28] In recent years, the studies have focused on abnormalities of the central nervous system. Indeed, the studies on neuropeptides and neurohormonal disorders, impaired central nervous system activity, autonomic dysfunction, and sleep disorders were also included in the T100 list.[29]

Another highlight of the T100 list was the treatment of FMS (n=18). The general message of these studies was that a comprehensive and multidisciplinary assessment of pain, functionality, and psychosocial characteristics should be made.[28,30–32] In the past 30 years, both pharmacological and non-pharmacological treatments related to the treatment of FMS have been published in the literature. Here, exercise therapy has a special importance. Aerobic exercises can reduce pain, depression, and fatigue and improve the quality of life in FMS.[5,33] In addition, toning up and flexibility exercises can also contribute. Tai Chi was researched in FMS due to the fact that it is a combined and medium-intensity exercise program. In a randomized controlled study, Tai Chi was demonstrated to impact pain severity, fibromyalgia effect scale, functional mobility, and sleep and quality of life scores.[6] As a matter of fact, the study in question was published in a journal having the highest impact factor on the T100 list, and it also had the highest altmetric attention score due to the interest of social media platforms in it as one of the most popular mind–body exercises today.

In the survey conducted for the period between 1990 and 2020, the highest number of articles (n=25) that made to the T100 list was from the period between 1994 and 1997 due to an increase in the number of studies conducted on this subject after the American College of Rheumatology identified fibromyalgia diagnostic criteria for the 1st time in 1990. No article published after 2017 could make it into the T100 list. However, citation is a process that requires time. It was demonstrated that an article could attain the maximum number of citations in approximately 3 years following its publication.[34] Therefore, the citation numbers for the articles published in 2017 and later may not have been correctly represented in the database search performed in this study. All, except one of the articles with high altmetric attention scores, were published in 2010 and later. The only article published before 2010 was the American College of Rheumatology classification criteria article, which can also be considered a milestone in the field of FMS.[17] The altmetric attention scores could not be calculated for 35 articles, and most of these articles had been published before 2000 due to the fact that altmetric analysis, which has been actively used only in recent years, has <10 years of data. The altmetric attention scores of the current articles can be expected to be higher. As a matter of fact, a wide range of data scanning was applied to determine the T100 article (including the period before the development of the concept of altmetric score) and by extending the scanning to the present new articles that have not yet completed the citation process were evaluated in this study. This situation is thought to be the reason for the moderate-poor correlation detected between the citation index or number of citations and altmetric scores. This can be considered as one of the limitations of the study.

The country with the highest contribution to the T100 list was the USA with 64 articles, as was the case in several medical fields. Similar results were obtained in the bibliometric analysis studies related to ankylosing spondylitis (AS) and rheumatoid arthritis (RA) in rheumatology.[7,14] In the RA study, the UK and the Netherlands came after the USA in the citation ranking, while in the AS study, China and Turkey followed the USA. In this study, Canada and Germany shared the second place with equal numbers of articles in the highest ranking of citations related to FMS. These findings may be a result of an excessive number of articles published in the USA and high scientific quality in the country, or due to the fact that the journals in which the articles were published were mostly from the USA and Canada. In earlier bibliometric studies, it was reported that the journals tend to publish articles produced in their respective regions.[14]

Most of the clinical trials listed on the FMS T100 list were case–control studies. This aspect is probably due to the fact that most of the articles on the list were the studies related to etiopathogenesis. Indeed, the list of a study that assessed T100 articles on RA was dominated by the studies on treatment efficacy, and as a result, the most common type of study was found to be randomized controlled studies.

The fact that the funding was less in the case of these articles on FMS is also one of the results of the present study. The bibliometric studies on RA and AS received higher funding in the given field. Thus, the number of the T100 articles on RA that secured funding was 69, whereas the number of the FMS T100 articles securing funding was 33. Nearly, most

of the articles that received funding were from the USA. This aspect suggests that the economic factor is an important factor in constructing/writing articles that have the potential to create high-quality scientific curiosity.

Further, one of the study limitations include the fact that the T100 list was formed only on the basis of the search performed in the Web of Science database; however, other databases such as Google Scholar and Scopus were not searched, and the articles written in languages other than English were not included in the analysis. In addition, the aspects of self-citation and citation interaction between countries were not investigated. Parameters that could have an impact on science, such as the income levels of countries were also excluded from the study.

Conclusion

A perspective on the level of interest in T100 articles containing different topics in FMS both in the world of science and in social media platforms is presented in this study. The high altmetric scores in therapeutic articles may be an indicator of the interest in or need in FMS treatment. The fact that diagnostic-based studies are at the forefront in the academic field may be a sign that more orientation to treatment modalities is required. It is hoped that these data will contribute to efforts to design new studies in this field. Nevertheless, there is a need for studies in which more extensive databases are used, languages other than English are included, and parameters at the country level are presented in more detail.

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Peer-rewiew: Externally peer-reviewed.

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Appendix 1. General information related to the top 100 cited articles on fibromyalgia (sorted by total citations)

No.	Title	Authors	CA	Source title	PY	TC	AS	CI	NA	AT
1	The American-College-of-Rheumatology 1990 Criteria for the Classification of Fibromyalgia - Report of the Multicenter Criteria Committee	Wolfe et al.	Wolfe	Arthritis & Rheumatology	1990	6254	85	201,74	24	1
2	The American College of Rheumatology Preliminary Diagnostic Criteria for Fibromyalgia and Measurement of Symptom Severity	Wolfe et al.	Wolfe	Arthritis Care & Research	2010	1736	57	157,82	10	1
3	The Prevalence and Characterıstıcs of Fibromyalgia in the General-Population	Wolfe et al.	Wolfe	Arthritis & Rheumatology	1995	1621	20	62,35	5	2
4	The Fibromyalgia Impact Questionnaire - Development and Validation	Burckhardt et al.	Burckhardt	Journal of Rheumatology	1991	1292	3	43,07	3	2
5	Functional Magnetic Resonance Imaging Evidence of Augmented Pain Processing in Fibromyalgia	Gracely et al.	Clauw	Arthritis & Rheumatology	2002	761	17	40,05	4	2
6	Fibromyalgia Criteria and Severity Scales for Clinical and Epidemiological Studies: A Modification of the ACR Preliminary Diagnostic Criteria for Fibromyalgia	Wolfe et al.	Wolfe	Journal of Rheumatology	2011	587	18	58,7	10	1
7	Pain Catastrophizing and Neural Responses to Pain Among Persons with Fibromyalgia	Gracely et al.	Clauw	Brain	2004	518	45	30,47	7	2
8	Management of Fibromyalgia Syndrome	Goldenberg et al.	Goldenberg	Jama-Journal of The American Medical Association	2004	504	11	29,65	3	3
9	An Internet Survey of 2,596 People with Fibromyalgia	Bennett et al.	Bennett	Bmc Musculoskeletal Disorders	2007	499	19	35,64	5	2
10	EULAR Evidence-Based Recommendations for the Management of Fibromyalgia Syndrome	Carville et al.	Carville	Annals of the Rheumatic Diseases	2008	483	14	37,15	20	3
11	Fibromyalgia a Clinical Review	Clauw et al.	Clauw	Jama-Journal of the American Medical Association	2014	476	245	68	1	3
12	Abnormal sensitization and temporal summation of second pain (wind-up) in patients	Staud et al.	Staud	Pain	2001	476	3	23,8	5	2

Appendix 1 (cont.). General information related to the top 100 cited articles on fibromyalgia (sorted by total citations)

No.	Title	Authors	CA	Source title	PY	TC	AS	CI	NA	AT
	with fibromyalgia syndrome									
13	Elevated cerebrospinal-fluid levels of substance-p in patients with the fibromyalgia syndrome	Russell et al.	Russell	Arthritis & Rheumatology	1994	442	14	16,37	8	2
14	Pregabalin for the treatment of fibromyalgia syndrome - Results of a randomized, double-blind, placebo-controlled trial	Crofford et al.	Crofford	Arthritis & Rheumatology	2005	417	9	26,06	10	2
15	A double-blind, multicenter trial comparing duloxetine with placebo in the treatment of fibromyalgia patients with or without major depressive disorder	Arnold et al.	Arnold	Arthritis & Rheumatology	2004	409	11	24,06	7	2
16	Hypothalamic-pituitary-adrenal axis perturbations in patients with fibromyalgia	Crofford et al.	Crofford	Arthritis & Rheumatology	1994	401	0	14,85	10	2
17	The Fibromyalgia Impact Questionnaire (FIQ): a review of its development, current version, operating characteristics and uses	Bennett et al	Bennett	Clinical and Experimental Rheumatology	2005	395	0	24,69	1	3
18	Comorbidity of fibromyalgia with medical and psychiatric-disorders	Hudson et al.	Hudson	American Journal of Medicine	1992	391	3	13,48	5	2
19	Possible deficiencies of pain modulation in fibromyalgia	Lautenbacher et al.	Lautenbacher	Clinical Journal of Pain	1997	379	3	15,79	2	2
20	Prevalence of Fibromyalgia: A Survey in Five European Countries	Branco et al.	Branco	Seminars in Arthritis and Rheumatism	2010	378	3	34,36	13	2
21	Fibromyalgia and overlapping disorders: The unifying concept of central sensitivity syndromes	Yunus et al.	Yunus	Seminars in Arthritis and Rheumatism	2007	378	12	27	1	3
22	Modulatory influence on somatosensory perception from vibration and heterotopic noxious conditioning stimulation (HNCS) in fibromyalgia patients and healthy subjects	Kosek et al.	Kosek	Pain	1997	378	9	15,75	2	2
23	Accelerated brain gray matter loss in fibromyalgia patients: Premature aging of the brain?	Kuchinad et al.	Bushnell	Journal of Neuroscience	2007	367	42	26,21	6	2
24	Widespread pain in fibromyalgia is related to a deficit of endogenous pain inhibition	Julien et al.	Julien	Pain	2005	367	2	22,94	4	2

Appendix 1 (cont.). General information related to the top 100 cited articles on fibromyalgia (sorted by total citations)

No.	Title	Authors	CA	Source title	PY	TC	AS	CI	NA	AT
25	Overlapping conditions among patients with chronic fatigue syndrome, fibromyalgia, and temporomandibular disorder	Aaron et al.	Aaron	Archives of Internal Medicine	2000	364	20	17,33	3	2
26	Cerebrospinal-fluid biogenic-amine metabolites in fibromyalgia fibrositis syndrome and rheumatoid-arthritis	Russel et al.	Russel	Arthritis & Rheumatology	1992	353	0	12,17	4	2
27	Fibromyalgia syndrome: Review of clinical presentation, pathogenesis, outcome measures, and treatment	Mease et al.	Mease	Journal of Rheumatology	2005	347	0	21,69	1	3
28	Intrinsic brain connectivity in fibromyalgia is associated with chronic pain intensity	Napadow et al.	Napadow	Arthritis & Rheumatology	2010	340	37	30,91	6	2
29	High rates of autoimmune and endocrine disorders, fibromyalgia, chronic fatigue syndrome and atopic diseases among women with endometriosis: a survey analysis	Sinaii et al.	Sinaii	Human Reproduction	2002	337	30	17,74	5	2
30	Neurophysiologic evidence for a central sensitization in patients with fibromyalgia	Desmeules et al.	Desmeules	Arthritis & Rheumatology	2003	332	8	18,44	8	2
31	A randomized, double-blind, placebo-controlled trial of duloxetine in the treatment of women with fibromyalgia with or without major depressive disorder	Arnold et al.	Arnold	Pain	2005	330	3	20,63	7	2
32	A randomized, sham-controlled, proof of principle study of transcranial direct current stimulation for the treatment of pain in fibromyalgia	Fregni et al.	Fregni	Arthritis & Rheumatology	2006	308	9	20,53	12	2
33	The London fibromyalgia epidemiology study: The prevalence of fibromyalgia syndrome in London, Ontario	White et al.	White	Journal of Rheumatology	1999	304	0	13,82	4	2
34	Evidence for spinal cord hypersensitivity in chronic pain after whiplash injury and in fibromyalgia	Banic et al.	Banic	Pain	2001	303	7	17,82	7	2

Appendix 1 (cont.). General information related to the top 100 cited articles on fibromyalgia (sorted by total citations)

No.	Title	Authors	CA	Source title	PY	TC	AS	CI	NA	AT
35	Fibromyalgia in women - abnormalities of regional cerebral blood-flow in the thalamus and the caudate-nucleus are associated with low pain threshold levels	Mountz et al.	Mountz	Arthritis & Rheumatology	1995	296	0	11,38	9	2
36	Decreased central mu-opioid receptor availability in fibromyalgia	Harris et al.	Harris	Journal of Neuroscience	2007	295	16	21,07	6	2
37	Sequential daily relations of sleep, pain intensity, and attention to pain among women with fibromyalgia	Affleck et al.	Affleck	Pain	1996	295	0	11,8	5	2
38	Catastrophizing and pain in arthritis, fibromyalgia, and other rheumatic disease	Edwards et al.	Edwards	Arthritis & Rheumatology	2006	293	15	19,53	4	3
39	Central sensitivity syndromes: A new paradigm and group nosology for fibromyalgia and overlapping conditions, and the related issue of disease versus illness	Yunus et al.	Yunus	Seminars in Arthritis and Rheumatism	2008	292	14	22,46	1	3
40	A randomized, double-blind crossover trial of fluoxetine and amitriptyline in the treatment of fibromyalgia	Goldenberg et al.	Goldenberg	Arthritis & Rheumatology	1996	288	6	11,52	5	2
41	Subgrouping of fibromyalgia patients on the basis of pressure-pain thresholds and psychological factors	Giesecke et al.	Giesecke	Arthritis & Rheumatology	2003	281	8	15,61	8	2
42	Antidepressant treatment of fibromyalgia a meta-analysis and review	Arnold et al.	Arnold	Psychosomatics	2000	279	6	13,29	3	4
43	Psychiatric disorders in patients with fibromyalgia - A multicenter investigation	Epstein et al.	Epstein	Psychosomatics	1999	277	0	12,59	12	2
44	Diffuse noxious inhibitory controls (DNIC) attenuate temporal summation of second pain in normal males but not in normal females or fibromyalgia patients	Staud et al.	Staud	Pain	2003	275	0	15,28	4	2
45	Chronic widespread pain and fibromyalgia: What we know, and what we need to know	Clauw et al	Clauw	Best Practice & Research: Clinical Rheumatology	2003	274	3	15,22	2	3

Appendix 1 (cont.). General information related to the top 100 cited articles on fibromyalgia (sorted by total citations)

No.	Title	Authors	CA	Source title	PY	TC	AS	CI	NA	AT
46	A randomized, controlled clinical-trial of education and physical-training for women with fibromyalgia	Burckhardt et al.	Burckhardt	Journal of Rheumatology	1994	274	0	10,15	4	2
47	Patient perspectives on the impact of fibromyalgia	Arnold et al.	Arnold	Patient Education and Counseling	2008	271	3	20,85	7	2
48	Central sensitization: a biopsychosocial explanation for chronic widespread pain in patients with fibromyalgia and chronic fatigue syndrome	Meeus et al.	Meeus	Clinical Rheumatology	2007	270	78	19,29	2	3
49	Comparison of patients with chronic fatigue syndrome, fibromyalgia, and multiple chemical sensitivities	Buchwald et al.	Buchwald	Archives of Internal Medicine	1994	265	3	9,81	2	2
50	A meta-analysis of fibromyalgia treatment interventions	Rossy et al.	Rossy	Annals of Behavioral Medicine	1999	259	27	11,77	8	4
51	Comorbid depression and anxiety in Fibromyalgia syndrome: Relationship to somatic and psychosocial variables	Thieme et al.	Thieme	Psychosomatic Medicine	2004	258	2	15,18	3	2
52	Family study of fibromyalgia	Arnold et al.	Arnold	Arthritis & Rheumatology	2004	258	9	15,18	8	2
53	A prospective, longitudinal, multicenter study of service utilization and costs in fibromyalgia	Wolfe et al.	Wolfe	Arthritis & Rheumatology	1997	257	0	10,71	8	2
54	Mindfulness training as an intervention for fibromyalgia: Evidence of postintervention and 3-year follow-up benefits in well-being	Grossman et al.	Grossman	Psychotherapy and Psychosomatics	2007	255	23	18,21	4	2
55	The relation between tender points and fibromyalgia symptom variables: Evidence that fibromyalgia is not a discrete disorder in the clinic	Wolfe et al.	Wolfe	Annals of the Rheumatic Diseases	1997	254	6	10,58	1	2
56	Altered reactivity of the hypothalamic-pituitary-adrenal axis in the primary fibromyalgia syndrome	Griep et al.	Griep	Journal of Rheumatology	1993	253	0	9,04	3	2
57	Efficacy and safety of duloxetine for treatment of fibromyalgia in patients with or without major depressive disorder: Results from a 6-month, randomized, double-blind, placebo-controlled,	Russell et al.	Chappell	Pain	2008	251	16	19,31	9	2

Appendix 1 (cont.). General information related to the top 100 cited articles on fibromyalgia (sorted by total citations)

No.	Title	Authors	CA	Source title	PY	TC	AS	CI	NA	AT
	fixed-dose trial									
58	Functional imaging of pain in patients with primary fibromyalgia	Cook et al.	Cook	Journal of Rheumatology	2004	250	0	14,71	6	2
59	Sensory dysfunction in fibromyalgia patients with implications for pathogenic mechanisms	Kosek et al.	Kosek	Pain	1996	250	0	10	3	2
60	Grip force in patients with rheumatoid-arthritis and fibromyalgia and in healthy-subjects-a study with the grippit instrument	Nordenskiold et al.	Nordenskiold	Scandinavian Journal Rheumatology	1993	249	3	8,89	2	2
61	Enhanced temporal summation of second pain and its central modulation in fibromyalgia patients	Price et al.	Price	Pain	2002	246	0	12,95	6	2
62	Temporal summation of pain from mechanical stimulation of muscle tissue in normal controls and subjects with fibromyalgia syndrome	Staud et al.	Staud	Pain	2003	243	0	13,5	6	2
63	Ketamine reduces muscle pain, temporal summation, and referred pain in fibromyalgia patients	Graven-Nielsen et al.	Graven-Nielsen	Pain	2000	241	20	11,48	8	2
64	Population study of tender point counts and pain as evidence of fibromyalgia	Croft et al.	Croft	British Medical Journal	1994	241	3	8,93	3	2
65	Generalized hypervigilance in fibromyalgia: Evidence of perceptual amplification	McDermid et al.	McDermid	Pain	1996	239	0	9,56	3	2
66	The Revised Fibromyalgia İmpact Questionnaire (FIQR): validation and psychometric properties	Bennett et al.	Bennett	Arthritis Research & Therapy	2009	236	6	19,67	6	2
67	The Tampa Scale for Kinesiophobia: further examination of psychometric properties in patients with chronic low back pain and fibromyalgia	Roelofs et al.	Roelofs	European Journal of Pain	2004	236	0	13,88	5	2
68	Comparison of amitriptyline, cyclobenzaprine, and placebo in the treatment of fibromyalgia - a randomized, double-blind clinical-trial	Carette et al.	Carette	Arthritis & Rheumatology	1994	236	9	8,74	12	2
69	Treatment of fibromyalgia with antidepressants -	O'Malley et al.	O'Malley	Journal of General	2000	234	0	11,14	6	4

Appendix 1 (cont.). General information related to the top 100 cited articles on fibromyalgia (sorted by total citations)

No.	Title	Authors	CA	Source title	PY	TC	AS	CI	NA	AT
	A meta-analysis			Internal Medicine						
70	Increased rates of fibromyalgia following cervical spine injury - A controlled study of 161 cases of traumatic injury	Buskila et al.	Buskila	Arthritis & Rheumatology	1997	231	5	9,63	5	2
71	The internet-based arthritis self-management program: A one-year randomized trial for patients with arthritis or fibromyalgia	Lorig et al.	Ritter	Arthritis & Rheumatology	2008	230	10	17,69	4	2
72	Autonomic dysfunction in patients with fibromyalgia: Application of power spectral analysis of heart rate variability	Cohen et al.	Cohen	Seminars in Arthritis and Rheumatism	2000	230	0	10,95	6	2
73	Hyperexcitability in fibromyalgia	Sorensen et al.	Sorensen	Journal of Rheumatology	1998	228	0	9,91	5	2
74	Fibromyalgia patients show an abnormal dopamine response to pain	Wood et al.	Bushnell	European Journal of Neuroscience	2007	227	10	16,21	8	2
75	Cytokines play an etiopathogenetic role in fibromyalgia: a hypothesis and pilot study	Wallace et al.	Wallace	Rheumatology	2001	227	0	11,35	6	2
76	Aspects of fibromyalgia in the general-population - sex, pain threshold, and fibromyalgia symptoms	Wolfe et al.	Wolfe	Journal of Rheumatology	1995	227	0	8,73	4	2
77	Effects of aerobic exercise versus stress management treatment in fibromyalgia	Wigers et al.	Wigers	Scandinavian Journal of Rheumatology	1996	225	0	9	3	2
78	A Randomized Trial of Tai Chi for Fibromyalgia	Wang et al.	Wang	New England Journal of Medicine	2010	221	171	20,09	8	2
79	Comorbidity of fibromyalgia and psychiatric disorders	Arnold et al.	Arnold	Journal of Clinical Psychiatry	2006	221	1	14,73	6	2
80	Altered heat pain thresholds and cerebral event-related potentials following painful CO_2-laser stimulation in subjects with fibromyalgia syndrome	Gibson et al.	Gibson	Pain	1994	221	0	8,19	5	2
81	Tramadol and acetaminophen combination tablets in the treatment of fibromyalgia pain: A double-blind, randomized, placebo-controlled study	Bennett et al.	Bennett	American Journal of Medicine	2003	220	7	12,22	4	2

Appendix 1 (cont.). General information related to the top 100 cited articles on fibromyalgia (sorted by total citations)

No.	Title	Authors	CA	Source title	PY	TC	AS	CI	NA	AT
82	Health status and disease severity in fibromyalgia - Results of a six-center longitudinal study	Wolfe et al.	Wolfe	Arthritis & Rheumatology	1997	219	3	9,13	8	2
83	Fibromyalgia and quality-of-life - a comparative-analysis	Burckhardt et al.	Burckhardt	Journal of Rheumatology	1993	218	3	7,79	3	2
84	Empowering processes and outcomes of participation in online support groups for patients with breast cancer, arthritis, or fibromyalgia	van Uden-Kraan et al.	van Uden-Kraan	Qualitative Health Research	2008	217	1	16,69	6	2
85	Worldwide Epidemiology of Fibromyalgia	Queiroz et al.	Queiroz	Current Pain and Headache Reports	2013	212	38	26,5	1	2
86	Cognitive function in fibromyalgia patients	Park et al.	Park	Arthritis & Rheumatology	2001	211	0	10,55	4	2
87	Psychiatric diagnoses in patients with fibromyalgia are related to health care-seeking behavior rather than to illness	Aaron et al.	Aaron	Arthritis & Rheumatology	1996	211	0	8,44	8	2
88	High-frequency of fibromyalgia in patients with chronic fatigue seen in a primary care practice	Goldenberg et al.	Goldenberg	Arthritis & Rheumatology	1990	211	0	6,81	4	2
89	Circadian studies of autonomic nervous balance in patients with fibromyalgia - A heart rate variability analysis	Martinez- Lavin et al.	Martinez-Lavin	Arthritis & Rheumatology	1998	210	0	9,13	4	2
90	Pressure pain threshold in pain-free subjects, in patients with chronic regional pain syndromes, and in patients with fibromyalgia syndrome	Granges et al.	Granges	Arthritis & Rheumatology	1993	209	0	7,46	2	2
91	Fibromyalgia prevalence, somatic symptom reporting, and the dimensionality of polysymptomatic distress: Results from a survey of the general population	Wolfe et al.	Wolfe	Arthritis Care & Research	2013	208	32	26	4	2
92	Multimethod assessment of experimental and clinical pain in patients with fibromyalgia	Lautenbacher et al.	Lautenbacher	Pain	1994	208	0	7,7	3	2
93	EULAR revised recommendations for the management of fibromyalgia	Macfarlane et al.	Macfarlane	Annals of the Rheumatic Diseases	2017	207	233	51,75	19	1
94	Efficacy of different types of aerobic exercise in fibromyalgia syndrome: a systematic review and	Haeuser et al.	Haeuser	Arthritis Research & Therapy	2010	207	9	18,82	7	4

Appendix 1 (cont.). General information related to the top 100 cited articles on fibromyalgia (sorted by total citations)

No.	Title	Authors	CA	Source title	PY	TC	AS	CI	NA	AT
	meta-analysis of randomised controlled trials									
95	Small fibre pathology in patients with fibromyalgia syndrome	Uceyler et al.	Uceyler	Brain	2013	205	90	25,63	9	2
96	Guidelines on the management of fibromyalgia syndrome - A systematic review	Haeuser et al.	Haeuser	European Journal of Pain	2010	205	19	18,64	3	1
97	Psychosocial factors in fibromyalgia compared with rheumatoid arthritis. Sexual, physical, and emotional abuse and neglect	Walker et al.	Walker	Psychosomatic Medicine	1997	205	0	8,54	6	2
98	Pain, disability, and physical functioning in subgroups of patients with fibromyalgia	Turk et al.	Turk	Journal of Rheumatology	1996	205	0	8,2	4	2
99	The impact of a meditation-based stress reduction program on fibromyalgia	Kaplan et al.	Kaplan	General Hospital Psychiatry	1993	205	0	7,32	3	2
100	Towards a model of pathophysiology of fibromyalgia - aberrant central pain mechanisms with peripheral modulation	Yunus et al.	Yunus	Journal of Rheumatology	1992	203	0	7	1	2

CA: Corresponding author; ST: Source title; PY: Publication year; TC: Total citations; AS: Altmetric score; CI: Citation index; NA: Number of authors; AT: Article type; Article type: 1; Clinical guideline, 2; Clinical study, 3; Review, 4; Meta-analysis, 5; Editorial.