A Bibliometric and Visualization Analysis of Mindfulness and Meditation Research from 1900 to 2021

Yuzheng Wang 1,2,3, Lingqiu Liao 1,2, Xiaoxiao Lin 1,2, Yabin Sun 1,2, Ning Wang 1,2, Jinyan Wang 1,2 and Fei Luo 1,2,*

1 CAS Key Laboratory of Mental Health, Institute of Psychology, Chinese Academy of Sciences, Beijing 100101, China; wangyz@psych.ac.cn (Y.W.); liaolq@psych.ac.cn (L.L.); linxx@psych.ac.cn (X.L.); sunyb@psych.ac.cn (Y.S.); wangni@psych.ac.cn (N.W.); wangji@psych.ac.cn (J.W.)
2 Department of Psychology, University of Chinese Academy of Sciences, Beijing 100049, China
3 Shanghai Key Laboratory of Mental Health and Psychological Crisis Intervention, School of Psychology and Cognitive Science, East China Normal University, Shanghai 200062, China
* Correspondence: luof@psych.ac.cn

Abstract: This study comprehensively summarizes research in the field of meditation, especially mindfulness meditation from 1900 to 2021, by analyzing the knowledge map through CiteSpace and VOSviewer software. Using “mindfulness” or “meditation” as the topic, articles included in the Science Citation Index Expanded and Social Sciences Citation Index were searched in the web of science core database, resulting in the selection of 19,752 articles. Over half a century ago, Deikman published the field’s first article in the Journal of Nervous and Mental Disease in 1963, and publications have soared in subsequent decades. The USA is in the core position in terms of global collaboration, total publication numbers, and total citations. The Mindfulness journal ranked first for the most published articles and citations. “The benefits of being present: Mindfulness and its role in psychological well-being,” written by Brown and Ryan, was the most cited article. Mindfulness, meditation, depression, intervention, stress reduction, stress, and anxiety are the top co-occurrence keywords. The timeline of cluster analysis discloses that before 2010, hypertension, cancer, mindfulness, generalized anxiety disorder, and other topics received great attention. In the decade since 2010, scholars have shown interest in meta-analysis, attention, and self-assessment, and keen attention to mindfulness-based interventions. These findings provide an important foundation to direct future research.

Keywords: mindfulness; meditation; CiteSpace; VOSviewer; bibliometric; well-being; health

1. Introduction

Meditation is comprised of a family of self-regulation practices that train attention and awareness to bring mental processes under greater voluntary control to thereby foster general mental well-being and development, and/or specific capacities such as calmness, clarity, and concentration [1]. Among the various categories of meditation, mindfulness, as “the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment,” has generated increasing scholarly attention [2]. The number of mindfulness and meditation studies has expanded in recent years. Multiple reviews and meta-analyses have analyzed and summarized the effects of meditation on behavior and brain imaging in clinical and non-clinical subjects, and have demonstrated significant physical and mental health benefits [3–6]. In addition, mindfulness is a popular practice. According to a survey conducted by the U.S. National Institutes of Health, 8% of American adults practiced meditation in 2012 [7].

In recent decades, the research on mindfulness and meditation has developed rapidly, and a variety of topics have emerged [3,6]. For example, research hotspots range from...
stress reduction [8–10] and prevention of depression recurrence [11,12], to attention improvement [13–15], pain analgesia [16], and even academic achievement improvement [17]. Despite the rapid development of mindfulness and meditation, it should be noted that there are still some conceptual and methodological issues in research on mindfulness and meditation, which have an important bearing on the future scientific understanding of mindfulness and meditation [18].

Therefore, an analysis of the development, current status, and the relationships between key points and important events of the mindfulness and meditation literature is essential to inform the direction of future research.

Bibliometrics is the cross-disciplinary science of quantitative analysis of all knowledge carriers by mathematical and statistical methods [19]. It is not only a relatively mature and important branch of intelligence science [20,21], but also a discipline that is based on quantitative analysis through the intersection and combination of philology, information science, mathematics, and statistics in a specific area [22]. With the rapid development of computer, network, and information technologies, the information of knowledge data becomes more open. Consequently, the bibliometrics method is used to describe, evaluate, and predict the status and development trend of scientific and technological research in certain fields [23]. The most obvious advantage of bibliometrics is that it allows scholars to study a specific research area by analyzing citations, co-citations, geographical distributions, and word frequencies to draw useful conclusions. Heretofore, bibliometrics has been widely used in hotspot research [24], co-authorship analysis [25], co-citation analysis [26], and the development of the whole subject fields [27].

The aim of this study was to reveal the inner structure pattern and citation landscape of mindfulness and meditation publications from a general perspective. CiteSpace and VOSviewer were used to analyze annual publication outputs, publication distributions by country and institution, author productivity, and collaboration patterns to provide an informed perspective on the evolution and development of mindfulness and meditation as a scientific discipline. Moreover, analyses of document co-citation networks, research clusters, and reference citation bursts were performed to offer insights into research topics and trend evaluations over time from different perspectives, thereby facilitating future research.

2. Methods

2.1. Search and Inclusion Criteria

Science Citation Index Expanded (SCI-E) and Social Sciences Citation Index (SSCI) articles from 1900 to 2021 (4 March 2021) were searched, with "mindfulness *" or "meditation *" as the theme, in the Web of Science Core Collection. Considering that mindfulness is an important part of meditation classification and the focus of the current research, and there is a mixture of mindfulness and meditation concepts in some studies [18,28,29], "mindfulness *" was especially emphasized when screening keywords. Only the documents of article or review type were included, while other document types such as meeting abstracts, letters, book reviews, and corrections were excluded. This search yielded 19,752 articles. Among the selected articles (19,752), a total of 561 papers were non-English. In the process of bibliometric analysis, the title, abstract, and keywords are the main analysis terms, and these sections are described in English, so they will not affect the final results.

2.2. Data Analysis

CiteSpace 5.3.R4 (Philadelphia, PA, USA) and VOSviewer 1.6.16 (Rotterdam, The Netherlands) were used for knowledge mapping analysis. CiteSpace is a Java application for analyzing and visualizing co-citation networks [30]. It supports structural and temporal analyses of a variety of networks, including collaboration networks, author co-citation networks, and document co-citation networks. It also supports networks of hybrid node types such as terms, institutions, and countries, and hybrid link types such as co-citation, co-occurrence, and directed citing links [30]. In this study, CiteSpace was used to analyze and visualize the reference co-citation clusters, timeline view of clusters, and the citation bursts.
VOSviewer is a software tool developed for constructing and viewing bibliometric maps. It constructs a map based on a co-occurrence matrix [31].

In the visualizations, one node represents a project (such as an author or a country), the size of the node reflects its importance (e.g., number of papers published by the project), and the color of the node signifies the group according to the default clustering method. Network connections denote collaborations between projects. The line width represents the intensity of collaboration. In this study, we used VOSviewer to make country collaboration, inter-institution collaboration, co-authorship, and co-citation networks.

Before analyzing the results, all the inconsistencies in the bibliographic data were standardized and corrected. These inconsistencies appeared due to errors in the process of capturing the WOS data, abbreviations, and mistakes made by the authors in the references. For example, to prevent classification errors, we uniformly revised the expressions cognitive behavior therapy, cognitive behaviour therapy, cognitive behavioural therapy, cognitive-behavior therapy, and cognitive behavioral therapy to cognitive-behavioral therapy. The inconsistencies were checked by the first author. See Appendix A Table A1 for details.

3. Results
3.1. General Analysis of Publications
3.1.1. Annual Comparative Analysis of Mindfulness and Meditation Publications

Meditation emphasizes mental development, such as bhavana (mental cultivation) in Buddhism and lien-hsin (refining the mind) in Taoism. In Western definitions, meditation is a self-regulation strategy with a particular focus on training attention [1]. The first meditation article was published by Deikman in the Journal of Nervous and Mental Disease in 1963 [32]. Eight subjects participated in the experiment, where four performed meditation for twelve sessions and the other four performed brief meditation control procedures. The participants learn about contemplative meditation, and concentrate on a blue vase without analyzing the different parts of the vase by thinking a series of thoughts about the vase. Results showed phenomena common to all subjects, such as perception of the vase (e.g., more vivid), time-shortening (e.g., feel less time elapsed), conflicting perceptions (e.g., the vase filled my visual field/It did not fill the field by any means), development of stimulus barriers (e.g., increase in ability to keep out distracting stimuli), personal attachment to the vase, and pleasurable quality (e.g., pleasurable, valuable, and rewarding). For the first time, this article described the meditation training methods and the subjects’ experience in great detail.

In addition to Deikman’s research, Kabat-Zinn played an important role in the promotion of meditation. Among the top 10 most frequently cited articles, Kabat-Zinn contributed 3 articles (cited 1804, 939, and 374 times). See Appendices B and C (Tables A2 and A3) for details. Kabat-Zinn’s pioneering contribution is that he has established a systematic eight-week mindfulness-based stress reduction (MBSR).

During the century from 1900 to 1999, only 625 meditation articles were published (5 in the 1960s, 174 in the 1970s, 115 in the 1980s, and 331 in the 1990s). Figure 1 depicts the numbers of publications and citations of mindfulness and meditation articles since 2000. The number of global mindfulness and meditation articles included in SCI-E/SSCI increased annually, from 131 per year in 2000 (0.70% of the total publications) to 2978 per year in 2020 (15.83% of the total publications). The number of articles published annually increased by over 30% during five particular years (46.46% in 2004, 33.91% in 2006, 37% in 2009, 35.31% in 2012, and 34% in 2019). The number of citations included in SCI-E/SSCI from 2000 to 2020 also increased annually, from only 517 (0.13% of total citations) in 2000 to 70,086 (17.17% of total citations) in 2020. Annual increases of at least 30% were observed in more than half of the included years.
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Figure 1. Mindfulness meditation publications (a) and citations (b)—annual distributions.

Figure 2a exhibits the changing trends of international and non-international collaborative publications, as well as percentages of international collaborative articles. Collaborations of institutions and authors are presented in Figure 2b,c, respectively. Increasing rates of collaborative research among countries (81.48%), institutions (91.38%), and authors (90.34%) reflect the prevailing trend. The proportion of collaborative articles accelerated most rapidly during 2007–2008, and continues to rise.

3.1.2. Most Cited Articles

Table 1 shows the 15 most cited mindfulness and meditation articles. “The benefits of being present: Mindfulness and its role in psychological well-being,” published in the Journal of Personality and Social Psychology (JPSP) by Brown and Ryan (2003) [33], was cited most frequently (4585 citations), followed by “Assessment and Clinical Psychology-Science and Practice” by Baer et al. (2006) [34] and “Mindfulness: A Proposed Operational Definition” by Bishop et al. (2004) [35], ranking second and third with 2849 and 2597 citations, respectively. The two most frequently cited articles described the development and psychometric properties of the Mindful Attention Awareness Scale (MAAS) and the Five-Facet Mindfulness Questionnaire (FFMQ), respectively. The third most cited article proposed a two-component model and an operational definition of mindfulness.
Figure 2. Collaborations of countries (a), institutions (b), and authors (c) in published articles.
Table 1. The 15 most cited mindfulness and meditation articles (1900 to 2021).

| Rank | Authors | Citations | Journal Title | Journal |
|------|---------|-----------|---------------|---------|
| 1    | Brown & Ryan (2003) [33] | 4585 | Journal of Personality and Social Psychology | The benefits of being present: Mindfulness and its role in psychological well-being |
| 2    | Baer et al., (2006) [34] | 2849 | Assessment | Using self-report assessment methods to explore facets of mindfulness |
| 3    | Bishop et al., (2004) [35] | 2597 | Clinical Psychology-Science and Practice | Mindfulness: A proposed operational definition |
| 4    | Kabat-zinn (2003) [2] | 2553 | Clinical Psychology-Science and Practice | Mindfulness-based interventions in context: Past, present, and future |
| 5    | Hayes et al., (2006) [36] | 2349 | Behaviour Research and Therapy | Acceptance and commitment therapy: Model, processes and outcomes |
| 6    | Baer (2003) [37] | 2004 | Clinical Psychology-Science and Practice | Mindfulness training as a clinical intervention: A conceptual and empirical review |
| 7    | Grossman et al., (2004) [38] | 1983 | Journal of Psychosomatic Research | Mindfulness-based stress reduction and health benefits: A meta-analysis |
| 8    | Hofmann et al., (2010) [39] | 1682 | Journal of Consulting and Clinical Psychology | The effect of mindfulness-based therapy on anxiety and depression: A meta-analytic review |
| 9    | Kabat-zinn (1982) [8] | 1666 | General Hospital Psychiatry | An outpatient program in behavioral medicine for chronic pain patients based on the practice of mindfulness meditation: Theoretical consideration |
| 10   | Teasdale et al., (2000) [12] | 1600 | Journal of Consulting and Clinical Psychology | Prevention of relapse/recurrence in major depression by mindfulness-based cognitive therapy |
| 11   | Deci & Ryan (2008) [40] | 1572 | Canadian Psychology—Psychologie Canadienne | Self-Determination Theory: A macrotheory of human motivation, development, and health |
| 12   | Brown, Ryan, & Creswell (2007) [41] | 1370 | Psychological Inquiry | Mindfulness: Theoretical foundations and evidence for its salutary effects |
| 13   | Shapiro et al., (2006) [42] | 1281 | Journal of Clinical Psychology | Mechanisms of mindfulness |
| 14   | Davidson et al., (2003) [43] | 1240 | Psychosomatic Medicine | Alterations in brain and immune function produced by mindfulness meditation |
| 15   | Diamond & Lee (2011) [44] | 1187 | Science | Interventions shown to aid executive function development in children 4 to 12 years old |

Among the top fifteen most cited publications, three authors contributed two articles each. For example, Brown published two highly cited articles in JPSP (4585 citations) as well as in Psychological Inquiry (1370 citations). Baer published highly cited articles in Assessment (2849 citations) and in Clinical Psychology-Science and Practice (CPSP, 2004 citations), while Kabat-Zinn wrote impactful papers in CPSP (2553 citations) and General Hospital Psychiatry (1666 citations).

The most cited source journal is JPSP, which publishes original papers in all areas of personality and social psychology, including attitude and social cognition, interpersonal relations and group processes, as well as personality processes and individual differences. Three highly cited articles were from CPSP (597, 2553, and 2004 citations), the official publication of the American Psychological Association Division 12, the Society of Clinical Psychology. The journal publishes papers regarding developments in the science and
practice of clinical psychology and related mental health fields. Two articles were from the *Journal of Consulting and Clinical Psychology* (JCCP, 1682 and 1660 citations), which publishes articles regarding prevention and treatment in all areas of clinical and clinical–health psychology, and especially on topics that appeal to a broad readership. The journal addresses a wide range of topics that include epidemiology, the use of psychological services, as well as healthcare economics of behavioral therapy.

### 3.1.3. Most Productive Countries/Territories

The total number of publications, total citations, and CP (citations/publication) can be used to analyze the impact of papers published in leading countries. The countries producing the most publications on mindfulness and meditation were the USA, England, Australia, Canada, Germany, the People’s Republic of China, The Netherlands, Spain, Italy, and India (Table 2). The USA has produced 47.99% of papers, higher than the percentage of papers published by the other top nine countries (45.51%). The citation frequency, particularly the CP, is an important indicator of research quality. The USA (265,856) generated far more total citations than England (50,257), followed by Canada (43,312). Canada ranked first in CP (31.25), followed by the USA (28.05), England (27.40), the Netherlands (26.10), and Germany (25.16).

**Table 2.** The 10 most prolific countries/regions.

| Rank | Country                          | Publications | Citations  | Citations/Publication | Leading Institute of Each Country (Publications) |
|------|----------------------------------|--------------|------------|-----------------------|-----------------------------------------------|
| 1    | USA                              | 9478         | 265,856    | 28.05                 | University of California System (910)         |
| 2    | England                          | 1834         | 50,257     | 27.40                 | University of London (393)                     |
| 3    | Australia                        | 1426         | 24,946     | 17.49                 | University of Melbourne (170)                  |
| 4    | Canada                           | 1386         | 43,312     | 31.25                 | University of Toronto (310)                    |
| 5    | Germany                          | 1128         | 28,383     | 25.16                 | University of Freiburg (104)                   |
| 6    | People’s Republic of China       | 912          | 10,230     | 11.22                 | Chinese University of Hongkong (125)          |
| 7    | The Netherlands                  | 735          | 19,184     | 26.10                 | Radboud University Nijmegen (170)             |
| 8    | Spain                            | 657          | 7076       | 10.77                 | University of Zaragoza (100)                   |
| 9    | Italy                            | 527          | 9389       | 17.82                 | Sapienza University Rome (86)                  |
| 10   | India                            | 384          | 4819       | 12.55                 | All India Institute of Medical Sciences, New Delhi (44) |

### 3.1.4. Most Productive Institutions

Nine of the ten most prolific institutions in the mindfulness and meditation field were located in the USA. The top three institutions were Harvard University, the University of Toronto, and the University of Washington. The top three institutions for total citations were Harvard University (20,074), the University of Massachusetts (17,572), and the University of Toronto (14,657), while articles from the University of Massachusetts (86.56), the University of Toronto (56.81), and the University of Wisconsin (51.24) generated the highest CP (Table 3).

### 3.1.5. Most Productive Journals

Table 4 shows the total number of articles published in the top 20 journals that address mindfulness and meditation, as well as the number of citations generated by the particular journal’s articles, and the consequent CP. Although the *Mindfulness* Journal began recently, in 2010, as a journal dedicated to the mindfulness field, it has published the largest number of articles (1288), followed by *Frontiers in Psychology* (442) and *Annals of Behavioral Medicine* (269). *Mindfulness* ranked first in total citations (15,208), followed by *Behavior Research and Therapy* (9601 citations) and *Personal and Individual Differences* (6084 citations). *Behavior Research and Therapy* ranked first in CP (76.81), followed by the *Journal of Clinical Psychology* (54.39) and *Consciousness and Cognition* (38.33). Three articles were cited more
than 1000 times, and these were Hayes et al. (2006) [36] from *Behavior Research and Therapy* (2327 citations), Shapiro et al. (2006) [42], *Journal of Clinical Psychology* (1273 citations), and Davidson et al. (2003) [43] from *Psychological Medicine* (1237 citations).

**Table 3.** Top 10 most productive institutions.

| Rank | Institution                             | Publications | Citations | Citation/Publication |
|------|-----------------------------------------|--------------|-----------|----------------------|
| 1    | Harvard University                      | 568          | 20,074    | 35.34                |
| 2    | University of Toronto                   | 258          | 14,657    | 56.81                |
| 3    | University of Washington                | 254          | 8589      | 33.81                |
| 4    | University of California, San Francisco | 240          | 6924      | 28.85                |
| 5    | University of California, Los Angeles   | 238          | 9854      | 41.40                |
| 6    | University of Wisconsin                 | 234          | 11,989    | 51.24                |
| 7    | University of North Carolina at Chapel Hill | 230         | 9194      | 39.97                |
| 8    | Brown University                        | 212          | 5181      | 24.44                |
| 9    | University of Massachusetts             | 203          | 17,572    | 86.56                |
| 10   | Duke University                         | 184          | 8439      | 45.86                |

**Table 4.** Top 20 journals that published mindfulness and meditation articles (1900 to 2021).

| Rank | Journal                                         | Article Number | Citations | Citations/Article | Most Cited Article                        | Citations of Most Cited Article |
|------|-------------------------------------------------|----------------|-----------|-------------------|-------------------------------------------|---------------------------------|
| 1    | Mindfulness                                      | 1288           | 15,208    | 11.81             | Eberth & Sedlmeier (2012) [3]             | 300                             |
| 2    | Frontiers in Psychology                         | 442            | 5039      | 11.40             | Zinner et al. (2014) [45]                 | 301                             |
| 3    | Annals of Behavioral Medicine                  | 269            | 2120      | 7.88              | Jain et al. (2007) [46]                   | 596                             |
| 4    | Journal of Alternative and Complementary Medicine | 246           | 5742      | 23.34             | Chiesa & Serretti (2009) [47]             | 691                             |
| 5    | Personality and Individual Differences          | 211            | 6,084     | 28.83             | Walach et al. (2006) [48]                 | 535                             |
| 6    | PLoS ONE                                        | 206            | 5681      | 27.58             | Lutz et al. (2008) [13]                   | 416                             |
| 7    | Psychosomatic Medicine                          | 182            | 5434      | 29.86             | Davidson et al. (2003) [43]               | 1237                            |
| 8    | Psycho Oncology                                 | 174            | 2022      | 11.62             | Lengacher et al. (2009) [49]              | 269                             |
| 9    | Library Journal                                 | 160            | 2         | 0.01              | Letts (2010) [50]                         | 1                               |
| 10   | Journal of Clinical Psychology                  | 144            | 7832      | 54.39             | Shapiro et al. (2006) [42]                | 1273                            |
| 11   | Behaviour Research and Therapy                  | 125            | 9601      | 76.81             | Hayes et al. (2006) [36]                  | 2327                            |
| 12   | Psychophysiology                                | 123            | 666       | 5.41              | Khalsa et al. (2008) [51]                 | 134                             |
| 13   | Explore: The Journal of Science and Healing     | 114            | 1967      | 17.25             | Garland et al. (2009) [52]                | 189                             |
| 14   | Complementary Therapies in Medicine             | 112            | 1521      | 13.58             | Dalen et al. (2010) [53]                  | 131                             |
| 15   | European Psychiatry                             | 111            | 164       | 1.48              | Weber et al. (2010) [54]                  | 52                              |
| 16   | Frontiers in Human Neuroscience                 | 110            | 3474      | 31.58             | Vago & Silbersweig (2012) [55]            | 418                             |
| 17   | Consciousness and Cognition International Journal of *Environmental Research and Public Health* | 107           | 4101      | 38.33             | Zeidan et al. (2010) [56]                 | 469                             |
| 18   | Journal of Child and Family Studies             | 104            | 2567      | 24.68             | Burke (2010) [58]                         | 335                             |
| 19   | Journal of Contextual Behavioral Science        | 100            | 550       | 5.5               | Francis et al. (2016) [59]                | 62                              |

### 3.2. Analysis of Collaborations

The results of our analysis of collaborations among countries (regions), institutions, and authors are presented in Figures 3 and 4. In the visualizations, one node represents a project (such as an author), the size of the node reflects the number of papers published by the project, and the color of the node signifies the group according to the default clustering method. Network connections denote collaborations between projects. The line width represents the intensity of collaboration.
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Figure 3. Inter-institution collaboration in mindfulness/meditation.

Figure 4. Keyword co-occurrence analysis network diagram in mindfulness/meditation.

3.2.1. Analysis of Collaborative Networks among Countries/Territories

Link strength, literature quantity, and citations are the indicators of collaborative degree. Figure 5 displays the collaborative network between countries (regions) in the mindfulness and meditation field (the threshold of link strength is set to 10). From the perspective of link strength, the USA (24,309,335 articles, 26,281 citations) has been the center of global collaboration in this field, and its international collaborative activity is much higher than that of other countries. The USA was followed by England (12,791,805 articles, 49,712 citations), Germany (8,031,114 articles, 28,146 citations), Australia (7,991,408 articles, 24,118 citations), Canada (7,251,368 articles, 43,154 citations), the Netherlands (584,731 articles, 18,971 citations), China (582,908 articles, 10,127 citations), Spain (472,653 articles, 7079 citations), Italy (462,653 articles, 9371 citations), Switzerland (358,305 articles, 8744 citations), and France (271,328 articles, 3998 citations).
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3.2.2. Analysis of Collaborative Networks among Institutions

The number of literature access was set to 30, and 264 of the 10,495 institutions meeting the standards were displayed. Figure 4 shows the inter-institution collaborative network (the threshold of link strength shown in the setting is 5). In terms of link strength, Harvard Medical School (strength 442,245, 2269 citations) was at the center of global collaboration, followed by Massachusetts General Hospital (strength 352,180, 5367 citations), Harvard University (strength 344,318, 17,747 citations), University of California, San Francisco (strength 334,237, 6644 citations), Brown University (309,209, 5064 citations), Stanford University (297,196, 7542 citations), the University of North Carolina System (288,227, 9179 citations), the University of Toronto (286,257, 14,639 citations), the University of Melbourne (269,170, 4200 citations), and the University of Massachusetts (249,201 articles, 17,207 citations).

3.3. Keyword Co-Occurrence Network Analysis

Keywords represent the highly concentrated content of literature research. The co-occurrence frequency of keywords can reflect dynamic trends of mindfulness and meditation research. Keywords with high frequencies reflect the focus of the research field. They identify advanced research methods, hot issues to be solved urgently, or academic topics of interest in particular timeframes.
Figure 5 shows the keyword co-occurrence analysis network diagram. All keywords were included in the analysis. Among all 30,430 keywords, the top 150 were displayed for mapping. The top 20 co-occurring keywords are shown in Table 5. Mindfulness and meditation were the most frequent, followed by depression, intervention, stress reduction, stress, and anxiety. The highly frequent use of keywords such as quality of life, health, emotion regulation, therapy, cognitive therapy, mental health, symptoms, and cognitive behavioral therapy reflect wide therapeutic applications of methods based on mindfulness, such as mindfulness-based cognitive therapy (MBCT) and mindfulness-based stress reduction (MBSR), that are used to prevent recurrent depression and to reduce stress. In addition, validation appeared frequently in keywords, such as the validity test of measurements of mindfulness. Keywords also reflected a large number of randomized controlled trial studies and meta-analyses to report empirical demonstrations of the clinical utility of mindfulness and meditation. In addition, attention and acceptance are also research foci. On one hand, mindfulness and meditation can improve the quality of attention and acceptance; on the other hand, attention and acceptance are the two core elements of mindfulness [60,61].

Table 5. Top 20 co-occurrence keywords.

| Rank | Keywords                        | Co-Occurrence Frequency | Total Link Strength |
|------|---------------------------------|-------------------------|--------------------|
| 1    | Mindfulness                     | 8149                    | 43,960             |
| 2    | Meditation                      | 3952                    | 21,263             |
| 3    | Depression                      | 3007                    | 19,986             |
| 4    | Intervention                    | 2285                    | 14,785             |
| 5    | Stress reduction                | 2266                    | 14,891             |
| 6    | Stress                          | 2123                    | 12,731             |
| 7    | Anxiety                         | 2052                    | 13,818             |
| 8    | Validation                      | 1607                    | 10,080             |
| 9    | Quality-of-life                 | 1444                    | 9131               |
| 10   | Health                          | 1422                    | 8552               |
| 11   | Randomized controlled trial     | 1382                    | 8536               |
| 12   | Meta-analysis                   | 1296                    | 8538               |
| 13   | Emotion regulation              | 1101                    | 7065               |
| 14   | Therapy                         | 1099                    | 6671               |
| 15   | Attention                       | 1084                    | 5726               |
| 16   | Acceptance                      | 1065                    | 7273               |
| 17   | Cognitive therapy               | 1063                    | 7333               |
| 18   | Mental health                   | 1056                    | 6757               |
| 19   | Symptoms                        | 987                     | 6823               |
| 20   | Cognitive-behavioral therapy    | 953                     | 5669               |

3.3.1. Co-Citation Analysis

If two items (such as articles) are cited together in the references of a cited item, they are co-cited. The number of co-citations can be used to measure the similarity and correlation between articles. Journal co-citations, article co-citations, and keyword co-citations can be analyzed according to different project contents.

3.3.2. Journal Co-Citation Analysis

Through the analysis of co-cited documents, we can obtain a knowledge base of a particular field. The research frontier is composed of a collection of cited literature that comprises these knowledge bases.

The VOSviewer identified 96,779 journals. Table 6 displays the results of our journal co-citation analysis. Figure 6 shows the co-citation connectivity between journals. The Journal of Personality and Social Psychology was the most frequently cited journal, and is in the core position of the network. The Journal of Consulting and Clinical Psychology ranked second.
Table 6. Analysis of journal co-citations.

| Rank | Journal                                                                 | Citations | Total Link Strength |
|------|-------------------------------------------------------------------------|-----------|---------------------|
| 1    | Journal of Personality and Social Psychology                           | 14,213    | 734,983             |
| 2    | Mindfulness                                                            | 13,867    | 690,677             |
| 3    | Journal of Consulting and Clinical Psychology                         | 11,888    | 629,722             |
| 4    | Behaviour Research and Therapy                                        | 11,567    | 626,786             |
| 5    | Clinical Psychology Review                                            | 8247      | 470,654             |
| 6    | Personality and Individual Differences                                 | 7148      | 371,525             |
| 7    | Clinical Psychology-Science and Practice                              | 7035      | 344,480             |
| 8    | Journal of Clinical Psychology                                        | 6914      | 375,828             |
| 9    | Plos One                                                               | 6459      | 405,257             |
| 10   | Psychological Bulletin                                                 | 6123      | 360,031             |
| 11   | Journal of Psychosomatic Research                                     | 5973      | 302,685             |
| 12   | Psychosomatic Medicine                                                | 5756      | 319,548             |
| 13   | Assessment                                                             | 5597      | 267,824             |
| 14   | Neuroimage                                                             | 5340      | 373,964             |
| 15   | Proceedings of the National Academy of Science of the United States    | 5212      | 349,800             |
| 16   | Pain                                                                   | 5147      | 285,924             |
| 17   | Journal of Alternative and Complementary Medicine                      | 4691      | 246,591             |
| 18   | Behaviour Therapy                                                     | 4677      | 256,028             |
| 19   | Frontiers in Psychology                                               | 4649      | 275,325             |
| 20   | Journal of the American Medical Association                            | 4648      | 231,798             |

Figure 6. Co-citation analysis network of journals in the field of mindfulness meditation.

3.3.3. Reference Co-Citation Analysis

A co-citation relationship is defined by the simultaneous citations of two papers in a third paper [62]. Reference co-citation analysis is an important means to detect the structure and evolutionary path of a specific domain. Figure 7 shows the top 1000 of
412,783 tabulated references. Among the top 20 most frequently cited articles, Kabat-Zinn and Baer contributed 4 articles each, while Brown authored 2 articles. Seven publications were review articles or meta-analyses [2,13,37–39,41]. Another six articles were classic papers written by leaders in the field introducing therapeutic interventions such as the MBSR [8–10], MBCT [11,12], and acceptance and commitment therapy (ACT) [63]. The other five articles reported the development of mindfulness questionnaires, such as the MAAS [36], FFMQ [34,64], and the Kentucky Inventory of Mindfulness Skills [65]. Stress and stress reduction are important co-occurrence keywords (Table 7), so the development of the Perceived Stress Scale (PSS) is also an important co-citation article [66]. There are also two articles on the mechanism of mindfulness [42,67].

Table 7. Analysis of reference co-citations.

| Rank | Authors (Year) Title Journal | Citations | Total Link Strength |
|------|-------------------------------|-----------|--------------------|
| 1    | Brown (2003) The benefits of being present: mindfulness and its role in psychological well-being Journal of Personality and Social Psychology | 3201 | 51,646 |
| 2    | *Kabat-Zinn* (1990) Full catastrophe living | 2326 | 41,070 |
| 3    | Baer (2006) Using self-report assessment methods to explore facets of mindfulness Assessment | 2298 | 42,161 |
| 4    | Bishop (2004) Mindfulness: a proposed operational definition Clinical Psychology-Science and Practice | 1956 | 38,294 |
| 5    | *Kabat-Zinn* (2003) Mindfulness-based interventions in context: past, present, and future Clinical Psychology-Science and Practice | 1695 | 27,948 |
| 6    | *Segal* (2002) Mindfulness-based cognitive therapy for depression: A new approach to preventing relapse | 1681 | 31,151 |
| 7    | Baer (2003) Mindfulness training as a clinical intervention: A conceptual and empirical review Clinical Psychology-Science and Practice | 1390 | 27,313 |

Next, the literature was divided into clusters. The log-likelihood test algorithm was used to extract nominal terms from the keywords of the cited literature and to name the clusters (Figure 8). To better reflect the time characteristics impacted by clustering, Figure 9 places the documents of the same cluster on the same horizontal timeline. The number of documents in each cluster can be clearly represented in the timeline view. The more articles in a cluster, the more important the clustering field. The timespan of documents in each category can also be obtained to further reflect the time characteristics influenced by clustering.

Figure 7. Co-citation analysis network diagram of references in the field of mindfulness meditation.
Table 7. Analysis of reference co-citations.

| Rank | Authors (Year) | Title |
|------|----------------|-------|
| 1    | Brown (2003) [33] | The benefits of being present: mindfulness and its role in psychological well-being |
| 2    | * Kabat-Zinn (1990) [9] | Full catastrophe living |
| 3    | Baer (2006) [34] | Using self-report assessment methods to explore facets of mindfulness |
| 4    | Bishop (2004) [35] | Mindfulness: a proposed operational definition |
| 5    | Kabat-Zinn (2003) [2] | Mindfulness-based interventions in context: past, present, and future |
| 6    | * Segal (2002) [11] | Mindfulness-based cognitive therapy for depression: A new approach to preventing relapse |
| 7    | Baer (2003) [37] | Mindfulness training as a clinical intervention: A conceptual and empirical review |
| 8    | Grossman (2004) [38] | Mindfulness-based stress reduction and health benefits: a meta-analysis |
| 9    | Kabat-Zinn (1982) [8] | An outpatient program in behavioral medicine for chronic pain patients based on the practice of mindfulness meditation: Theoretical considerations and preliminary results |
| 10   | Hofmann (2010) [39] | The effect of mindfulness-based therapy on anxiety and depression: A meta-analytic review |
| 11   | * Kabat-Zinn (1994) [10] | Wherever you go, there you are: Mindfulness meditation in everyday life |
| 12   | Shapiro (2006) [42] | Mechanisms of mindfulness |
| 13   | Brown (2007) [41] | Mindfulness: theoretical foundations and evidence for its salutary effects |
| 14   | Baer (2008) [64] | Construct validity of the five-facet mindfulness questionnaire in meditating and nonmeditating samples |
| 15   | * Hayes (1999) [63] | Acceptance and commitment therapy: An experiential approach to behavior change |
| 16   | Teasdale (2000) [12] | Prevention of relapse/recurrence in major depression by mindfulness-based cognitive therapy |
| 17   | Holzel (2011) [67] | How does mindfulness meditation work? Proposing mechanisms of action from a conceptual and neural perspective |
| 18   | Cohen (1983) [66] | A global measure of perceived stress |
| 19   | Baer (2004) [65] | Assessment of mindfulness by self-report: The Kentucky inventory of mindfulness skills |
| 20   | Lutz (2008) [13] | Attention regulation and monitoring in meditation |

Citations and Total Link Strength

| Citation | Journal |
|----------|---------|
| 3201     | Journal of Personality and Social Psychology |
| 2326     | - |
| 2298     | Assessment |
| 1956     | Clinical Psychology-Science and Practice |
| 1695     | Clinical Psychology-Science and Practice |
| 1681     | - |
| 1390     | Clinical Psychology-Science and Practice |
| 1355     | Journal of Psychosomatic Research |
| 1240     | General Hospital Psychiatry |
| 1214     | Journal of Consulting and Clinical Psychology |
| 1154     | - |
| 988      | Journal of Clinical Psychology |
| 975      | Psychological Inquiry |
| 969      | Assessment |
| 946      | - |
| 933      | Journal of Consulting and Clinical Psychology |
| 862      | Perspective on Psychological Science |
| 852      | Journal of Health and Social Behavior |
| 785      | Assessment |
| 780      | Trends in Cognitive Science |

*Book.
3.4. Burst Detection Analysis

Publications receiving a surging citation frequency reflect emerging trends in scientific research fields. Citation bursts suggest increased scholarly attention to the corresponding publications. Table 8 lists the top 30 references with the strongest citation bursts cited by INS publications. Green color indicates the years since the article was published. Red color indicates the years with citation bursts.
Table 8. Top 30 references with the strongest citation bursts.

| References        | Strength | Begin | End   |
|-------------------|----------|-------|-------|
| Brown (2003) [33] | 198.32   | 2005  | 2011  |
| Baer (2006) [34]  | 191.14   | 2009  | 2014  |
| Baer (2003) [37]  | 156.41   | 2003  | 2011  |
| Segal (2002) [11] | 152.23   | 2003  | 2010  |
| Grossman (2004) [38] | 151.87 | 2006  | 2012  |
| Hofmann (2010) [39] | 148.33 | 2013  | 2018  |
| Bishop (2004) [35] | 124.1    | 2006  | 2012  |
| Tang (2015) [65]  | 116.86   | 2017  | 2021  |
| Brown (2007) [41] | 113.32   | 2009  | 2015  |
| Davidson (2003) [43] | 113.22 | 2004  | 2011  |
| van Dam (2018) [28] | 104.59  | 2019  | 2021  |
| Holzel (2011) [67] | 102.54   | 2015  | 2019  |
| Baer (2004) [65]  | 95.357   | 2006  | 2012  |
| Shapiro (2006) [42] | 95.147  | 2009  | 2014  |
| Gu (2015) [69]    | 93.673   | 2017  | 2021  |
| Teasdale (2000) [12] | 89.247  | 2002  | 2008  |
| Lutz (2008) [13]  | 88.544   | 2010  | 2016  |
| Kabat-zinn (2003) [2] | 88.026  | 2004  | 2011  |
| Goyal (2014) [70] | 84.49    | 2016  | 2021  |
| Keng (2011) [71] | 81.431   | 2014  | 2019  |
| Ma (2004) [72]    | 81.234   | 2005  | 2011  |
| Khoury (2015) [73] | 80.751   | 2017  | 2021  |
| Carmody (2008) [74] | 80.172  | 2010  | 2015  |
| Khoury (2013) [75] | 78.538   | 2016  | 2021  |
| Lazar (2005) [76] | 77.052   | 2007  | 2013  |
| Hayes (2006) [36] | 74.695   | 2007  | 2013  |
| Hayes (2013) [77] | 73.719   | 2016  | 2021  |
| Jha (2007) [78]   | 73.3     | 2009  | 2015  |
| Creswell (2017) [79] | 72.008  | 2018  | 2021  |
| Cahn (2006) [80]  | 71.744   | 2008  | 2013  |

Green color indicates the years since the article was published. Red color indicates the years with citation bursts.

CiteSpace provides burst detection that can detect large changes in the number of citations in a particular timeframe, and is used to identify the declining or increasing use of a topic word or keyword. Table 8 presents the results of the emergent analysis of the top 30 publications. The red segments show the starting and ending times of particular literature bursts. The strongest burst citation was exhibited by an article by Brown et al. [33] that reported the development of the MAAS questionnaire to explore the benefits of mindfulness in improving psychological well-being. The next strongest bursts were associated with two articles by Baer that introduced the FFMQ questionnaire and discussed the five elements of mindfulness (2006) [34], and that reviewed the clinical utility of mindfulness training (2003). The earliest article in our burst detection analysis was a review by Teasdale et al. [12], one of the developers of MBCT, who utilizes mindfulness cognitive therapy to prevent recurrent depression.

4. Discussion

Our study provided a comprehensive perspective of the evolution and development of mindfulness and meditation literature. By using bibliometric methods and customized text mining techniques, we analyzed distribution (including distributions of countries/territories, institutions, and journals), collaboration (including international, interinstitutional, and inter-author collaborations), and document co-citations (including keyword co-occurrence networks, journal co-citations, reference co-citations, and reference citation bursts).
First, the number of publications and citations may reflect the overall development of the mindfulness and meditation field. No papers on mindfulness and meditation were published until over half a century ago, when Deikman [32] published the field’s seminal article in the *Journal of Nervous and Mental Disease*.

Consequently, mindfulness and meditation research have a long history. However, the numbers of mindfulness and meditation-related publications fluctuated at low levels during the 20th century. Since 2004, the number of publications has increased by more than 30% every few years. The citation rate has increased by more than 30% in over half of the years since 2002. At the same time, the prevailing trend in mindfulness and meditation literature has been towards increased collaboration among countries, institutions, and authors.

Second, from the perspective of distribution, the USA has been the center of global collaboration, and its strength of cooperation has been much higher than that of other countries. The USA also has led other countries in total numbers of publications and citations. However, Canada ranked first in the CP. From the perspective of research institutions, Harvard University ranked first in total numbers of publications and citations, while the University of Massachusetts ranked first in the CP. Nine of the top ten institutions in the global field of mindfulness and meditation are located in the United States. Harvard Medical School has been at the center of inter-institution collaboration. Taken together, our data indicate that the USA is in the core position in the field of mindfulness and meditation.

Third, in terms of the influence of journals and authors, *Mindfulness* ranked first for the most published articles and citations. However, *Behavior Research and Therapy* ranked first in the CP. From the perspective of journal co-citation analysis, JPSP has the most co-citations and the largest link strength, followed by *Mindfulness*. Brown and Ryan are the most cited authors, due to multiple citations of their article: “The benefits of being present: Mindfulness and its role in psychological well-being” [33].

Fourth, keyword analysis disclosed that in general, physical and mental health disorders such as depression, anxiety, stress, emotion regulation, and quality of life have been the primary research foci in the field of mindfulness and meditation, which reflects its wide therapeutic applications. At the same time, a large number of randomized controlled trials and meta-analyses have been completed. Researchers have also paid attention to validity of measurement tools and the mechanism of mindfulness and meditation.

Fifth, JPSP, *Mindfulness*, and JCCP are the leading journals in the field of mindfulness and meditation. The common concerns of scholars include reviews and meta-analyses of the clinical utility of mindfulness and meditation, and these include the classic articles by the developers of MBSR, MBCT, and ACT, and mindfulness-related questionnaires. The timeline of cluster analysis discloses that before 2010, hypertension, cancer, mindfulness, generalized anxiety disorder, and other topics received great attention. In the decade since 2010, scholars have shown interest in meta-analysis, attention, and self-assessment, and keen attention to mindfulness-based interventions. The development of MAAS and FFMQ questionnaires and the studies of the clinical efficacy of mindfulness and meditation showed the strongest bursts. A review of the effect of MBCT on preventing recurrent depression showed the earliest citation burst.

Recently, another article using the bibliometric method to analyze mindfulness hotspots was published [81]. In contrast, the inclusion criteria of the two articles are different, and the final results are somewhat different. For example, Baminiwatta and Solangaarachchi (2021) [81] searched for articles from 1966 to 2021 in the WOS core collection, with mindfulness as the topic. Finally, 16,581 articles were included. In this study, SCI-E and SSCI articles from 1900 to 2021 (4 March 2021) were searched, with “mindfulness” or “meditation” as the topic in the WOS core collection, and 19,752 articles were included. Therefore, Baminiwatta and Solangaarachchi (2021) [81] found that the first mindfulness article was “Mindfulness of Perception” published in 1966, and we found that the first article in the meditation field was “Experimental meditation” in 1963. Meditation and mindfulness are closely related, so the two articles can complement each other from different views.
5. Implications and Future Directions

Citation bursts reflect the emerging trends in scientific research fields and suggest the future directions. Tang et al., (2015) [68] showed the strongest citation bursts among the recent emerging ones. The authors described the neuroscience of mindfulness meditation and recommended that further research with longitudinal, randomized, and actively controlled research designs and larger sample sizes are needed to advance the understanding of the mechanisms of mindfulness and meditation [68,73].

It is essential to pay attention to misinformation and poor methodology in previous mindfulness studies, with a particular focus on assessment, mindfulness training, possible alternative effects, and intersection with brain imaging in the future [28]. Scholars believe that future research in meditation would benefit from addressing the remaining methodological and conceptual issues [70,73,75].

Furthermore, effectiveness studies that carefully consider how to reach out to communities of need with evidence-based, cost-effective, and sustainable mindfulness interventions are needed in the coming years [79]. The timeline of analysis of clusters also confirmed that mindfulness-based interventions are still an ongoing trend.

6. Limitations

Although meditation can be roughly divided into focused attention meditation and open monitoring meditation, it is difficult to separate specific meditation techniques (e.g., Chan, Taichi, Baduanjin qigong), so the subcategories of meditation were not compared in this study.

The names of the clusters were obtained by extracting terms from the keywords of the references through the log likelihood test algorithm. Since over 19,752 articles were identified, it was impossible for the authors to refine and analyze the content of each article. Since the articles were not randomly checked as to whether they are related to the topic, this may be problematic because some terms, such as meditation, have multiple meanings in English, some of which are irrelevant. Another major limitation is that the search was limited to databases (SCI-E, SSCI) that mainly include English publications, excluding most journals published in other languages. This will bias the results. For example, if Chinese or Korean databases were included, the results may be very different from those of a large number of papers in East Asia.

As an interdisciplinary science of quantitative analysis, bibliometrics can predict the status and development trend of mindfulness and meditation. Despite these advantages, it cannot recommend which method is better through indicators such as effect size, as in meta-analysis. Furthermore, bibliometric analysis is mainly based on the abstract, title, keywords, and references, without checking the full text of the paper, which also affects the final results.

In conclusion, this study provided a comprehensive review and intuitive analysis of publications related to mindfulness and meditation from 1900 to 2021. Using two effective bibliometric tools, VOSviewer and CiteSpace, this paper analyzed status and development trends of this field from many perspectives, and may inform future research in the field of mindfulness and meditation.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. Items before and after unification.

| NO. | Items before unification | Replace by |
|-----|--------------------------|------------|
| 1   | acceptance and commitment therapy (act) | acceptance and commitment therapy |
| 2   | act | acceptance and commitment therapy |
| 3   | adolescent | adolescents |
| 4   | adult | adults |
| 5   | african americans | african-americans |
| 6   | african-american | african-americans |
| 7   | alcohol dependence | alcohol |
| 8   | alcohol-use | alcohol |
| 9   | alzheimers-disease | alzheimer’s disease |
| 10  | anterior cingulate | anterior cingulate cortex |
| 11  | anxiety disorder | anxiety disorders |
| 12  | associations | association |
| 13  | autonomic nervous system | autonomic nervous-system |
| 14  | behavior therapy | behavioral therapy |
| 15  | behavior-therapy | behavioral therapy |
| 16  | blood pressure | blood-pressure |
| 17  | behaviors | behavior |
| 18  | body image | body-image |
| 19  | borderline personality disorder | borderline personality-disorder |
| 20  | brain activity | brain |
| 21  | breast cancer | breast-cancer |
| 22  | breast-cancer patients | breast-cancer |
| 23  | breast-cancer survivors | breast-cancer |
| 24  | buddhist | buddhism |
| 25  | cancer outpatients | cancer |
| 26  | cancer-patients | cancer |
| 27  | cardiovascular disease | cardiovascular-disease |
| 28  | caregiver | caregivers |
| 29  | child | children |
| 30  | childbirth | children |
| 31  | childhood | children |
| 32  | clinical-trials | clinical-trial |
| 33  | cognitive behavior therapy | cognitive-behavioral therapy |
| 34  | cognitive behaviour therapy | cognitive-behavioral therapy |
| 35  | cognitive behavioural therapy | cognitive-behavioral therapy |
| 36  | cognitive-behavior therapy | cognitive-behavioral therapy |
| 37  | cognitive behavioral therapy | cognitive-behavioral therapy |
| 38  | college | college-students |
| 39  | college students | college-students |
| 40  | commitment | commitment therapy |
| 41  | compassion meditation | compassion |
| 42  | complementary medicine | complementary and alternative medicine |
| 43  | complementary therapies | complementary and alternative medicine |
| 44  | construct | construct-validity |
| NO. | Items Replace by |
|-----|------------------|
| 45  | coping strategies coping |
| 46  | default mode default mode network |
| 47  | default network default mode network |
| 48  | deficit/hyperactivity disorder deficit hyperactivity disorder |
| 49  | depression scale depression |
| 50  | depressive symptoms depression |
| 51  | depressive relapse depression |
| 52  | dialectical behavior therapy dialectical behavior-therapy |
| 53  | disabilities disability |
| 54  | disorder disorders |
| 55  | eating behaviors eating behavior |
| 56  | eating-disorders eating disorders |
| 57  | emotion-regulation emotion regulation |
| 58  | emotional regulation emotion regulation |
| 59  | emotions emotion |
| 60  | executive functions executive function |
| 61  | family families |
| 62  | group intervention group therapy |
| 63  | heart rate heart-rate-variability |
| 64  | heart rate variability heart-rate-variability |
| 65  | heart-rate heart-rate-variability |
| 66  | individual differences individual-differences |
| 67  | intellectual disabilities intellectual disability |
| 68  | interventions intervention |
| 69  | loving-kindness loving-kindness meditation |
| 70  | major depressive disorder major depression |
| 71  | mechanism mechanisms |
| 72  | mediator mediators |
| 73  | medical students medical-students |
| 74  | mental health mental-health |
| 75  | meta-analysis meta-analysis |
| 76  | mbsr mindfulness based stress reduction |
| 77  | mindfulness-based stress reduction (mbsr) mindfulness based stress reduction |
| 78  | models model |
| 79  | moderators moderator |
| 80  | multiple-sclerosis multiple sclerosis |
| 81  | music therapy music-therapy |
| 82  | needs need |
| 83  | network networks |
| 84  | older adults older-adults |
| 85  | parent parents |
| 86  | perceptions perception |
| 87  | personality-trait personality |
| 88  | positive emotion positive emotions |
| 89  | posttraumatic stress disorder posttraumatic-stress-disorder |
| 90  | posttraumatic stress posttraumatic-stress |
| 91  | predictor predictors |
| 92  | prediction predictors |
| 93  | primary care primary-care |
| 94  | prostate-cancer outpatients prostate-cancer |
| 95  | psychological intervention psychological interventions |
| 96  | psychological treatment psychological treatments |
| 97  | quality of life quality-of-life |
| 98  | randomised controlled trial randomized controlled-trial |
| 99  | randomized controlled trial randomized controlled-trial |
| 100 | randomized controlled trials randomized controlled-trial |
| 101 | randomized controlled-trials randomized controlled-trial |
| 102 | randomized-controlled-trial randomized controlled-trial |
Table A1. Cont.

| NO. | Items Replace by          |
|-----|---------------------------|
| 103  | religiosity | religion |
| 104  | resting-state | resting state |
| 105  | scales | scale |
| 106  | schools | school |
| 107  | smoking cessation | smoking-cessation |
| 108  | strategy | strategies |
| 109  | stress reduction intervention | stress reduction |
| 110  | stress reduction program | stress reduction |
| 111  | stress reduction mbsr | stress reduction |
| 112  | student | students |
| 113  | style | styles |
| 114  | tai-chi | tai chi |
| 115  | therapies | therapy |
| 116  | thoughts | thought |
| 117  | transcendental meditation | transcendental-meditation |
| 118  | university students | university-students |
| 119  | validity | validation |
| 120  | weight loss | weight-loss |
| 121  | wellbeing | well-being |
| 122  | working memory | working-memory |
| 123  | young adults | young-adults |
| 124  | zen | zen meditation |

Appendix B

Table A2. The 10 most prolific countries/regions (1900–1999).

| Rank | Country | Publications | Citations | Citations/Publication |
|------|---------|--------------|-----------|-----------------------|
| 1    | USA     | 328          | 17,390    | 53.02                 |
| 2    | England | 37           | 765       | 20.68                 |
| 3    | Canada  | 32           | 699       | 21.84                 |
| 4    | Germany | 20           | 1935      | 96.75                 |
| 5    | Australia | 17          | 836       | 49.18                 |
| 6    | India   | 13           | 218       | 16.77                 |
| 7    | New Zealand | 8          | 53        | 6.63                  |
| 8    | France  | 7            | 5         | 0.71                  |
| 9    | Spain   | 6            | 111       | 18.5                  |
| 10   | Switzerland | 6          | 198       | 33                    |
Appendix C

Table A3. The top 10 cited articles (1900–1999).

| Rank | First Author     | Year | Journal                        | Article                                                                                                                                  | Citations |
|------|------------------|------|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 1    | Kabat-zinn, J     | 1982 | General Hospital Psychiatry    | An outpatient program in behavioral medicine for chronic pain patients based on the practice of mindfulness meditation— theoretical    | 1804      |
|      |                   |      |                                | considerations and preliminary-results Salivary cortisol in psychoneuroendocrine research— recent developments and applications Organizing |           |
|      |                   |      |                                | for high reliability: Processes of collective mindfulness                                                                                   |           |
| 2    | Kirschbaum, C     | 1994 | Psychoneuroendocrinology       | Effectiveness of a meditation-based stress reduction program in the treatment of anxiety disorders                                        | 939       |
| 3    | Weick, KE         | 1999 | Research in Organizational    |                                                                                                                                         | 995       |
|      |                   |      | Behavior                      |                                                                                                                                         |           |
| 4    | Kabat-zinn, J     | 1992 | American Journal of Psychiatry | Mindful practice                                                                                                                          | 766       |
| 5    | Epstein, RM       | 1999 | JAMA-Journal of the American  | Effects of mindfulness-based stress reduction on medical and premedical students 3-year follow-up and clinical implications of a       | 762       |
|      |                   |      | Medical Association            | mindfulness mediation-based stress reduction intervention in the treatment of anxiety disorders                                         |           |
| 6    | Shapiro, SL       | 1998 | Journal of Behavioral Medicine | Physiological effects of transcendental meditation                                                                                      | 491       |
| 7    | Miller, JJ        | 1995 | General Hospital Psychiatry    | Influence of a mindfulness meditation-based stress reduction intervention on rates of skin                                           | 391       |
| 8    | Wallace, RK       | 1970 | Science                        | clearing in patients with moderate to severe psoriasis undergoing phototherapy (UVB) and photochemotherapy (PUVA)                      | 374       |
| 9    | Kabat-zinn, J     | 1998 | Psychosomatic Medicine         | Stress reduction through mindfulness meditation—Effects on psychological symptomatology, sense of control, and spiritual experiences | 329       |
| 10   | Astin, JA         | 1997 | Psychotherapy and Psychosomatics|                                                                                                                                         |           |

References

1. Walsh, R.; Shapiro, S.L. The meeting of meditative disciplines and Western psychology: A mutually enriching dialogue. *Am. Psychol.* 2006, 61, 227–239. [CrossRef]
2. Kabat-Zinn, J. Mindfulness-Based Interventions in Context: Past, Present, and Future. *Clin. Psychol. Sci. Pract.* 2003, 10, 144–156. [CrossRef]
3. Eberth, J.; Sedlmeier, P. The Effects of Mindfulness Meditation: A Meta-Analysis. *Mindfulness* 2012, 3, 174–189. [CrossRef]
4. Fox, K.C.; Nijeboer, S.; Dixon, M.L.; Floman, J.L.; Ellamil, M.; Rumak, S.P.; Christoff, K. Is meditation associated with altered brain structure? A systematic review and meta-analysis of morphometric neuroimaging in meditation practitioners. *Neurosci. Biobehav. Rev.* 2014, 43, 48–73. [CrossRef] [PubMed]
5. Howarth, A.; Smith, J.G.; Perkins-Porras, L.; Ussher, M. Effects of Brief Mindfulness-Based Interventions on Health-Related Outcomes: A Systematic Review. *Mindfulness* 2019, 10, 1957–1968. [CrossRef]
6. Sedlmeier, P.; Eberth, J.; Schwarz, M.; Zimmermann, D.; Haarig, E.; Jaeger, S.; Kunze, S. The Psychological Effects of Meditation: A Meta-Analysis. *Psychol. Bull.* 2012, 138, 1139–1171. [CrossRef] [PubMed]
7. Clarke, T.C.; Black, L.I.; Stussman, B.J.; Barnes, P.M.; Nahin, R.L. Trends in the use of complementary health approaches among adults: United States, 2002–2012. *Natl. Health Stat. Rep.* 2015, 10, 1–16.
8. Kabat-Zinn, J. An outpatient program in behavioral medicine for chronic pain patients based on the practice of mindfulness meditation: Theoretical considerations and preliminary results. *Gen. Hosp. Psychiatry* 1982, 4, 33–47. [CrossRef]
9. Kabat-Zinn, J. *Full Catastrophe Living: Using the Wisdom of Your Mind and Body to Face Stress, Pain, and Illness*; Delacorte: New York, NY, USA, 1990; pp. 59–72.
10. Kabat-Zinn, J. *Wherever You Go, There You Are: Mindfulness Meditation in Everyday Life*; Hyperion: New York, NY, USA, 1994.
11. Segal, Z.V.; Williams, J.M.G.; Teasdale, J.D. *Mindfulness-Based Cognitive Therapy for Depression: A New Approach to Preventing Relapse*; Guilford Press: New York, NY, USA, 2002; pp. 359–360.
12. Teasdale, J.D.; Segal, Z.V.; Williams, J.M.G.; Ridgeway, V.A.; Soulsby, J.M.; Lau, M.A. Prevention of relapse/recurrence in major depression by mindfulness-based cognitive therapy. *J. Consult. Clin. Psychol.* 2000, 68, 615. [CrossRef] [PubMed]
13. Lutz, A.; Slagter, H.A.; Dunne, J.D.; Davidson, R.J. Attention regulation and monitoring in meditation. *Trends Cogn. Sci.* 2008, 12, 163–169. [CrossRef]

14. Wang, Y.; Chen, Y.; Sun, Y.; Zhang, K.; Wang, N.; Sun, Y.; Lin, X.; Wang, J.; Luo, F. Gender differences in the benefits of meditation training on attentional blink. *Curr. Psychol.* 2021, 1–10. [CrossRef]

15. Wang, Y.; Xiao, L.; Gong, W.; Chen, Y.; Lin, X.; Sun, Y.; Wang, N.; Wang, J.; Luo, F. Mindful non-reactivity is associated with improved accuracy in attentional blink testing: A randomized controlled trial. *Curr. Psychol.* 2021, 13. [CrossRef]

16. Grant, J.A. Meditative analgesia: The current state of the field. *Ann. N. Y. Acad. Sci.* 2014, 1307, 55–63. [CrossRef] [PubMed]

17. Mrazek, M.D.; Franklin, M.S.; Phillips, D.T.; Baird, B.; Schooler, J.W. Mindfulness training improves working memory capacity and GRE performance while reducing mind wandering. *Psychol. Sci.* 2013, 24, 776–781. [CrossRef] [PubMed]

18. Davidson, R.J.; Kasznia, A.W. Conceptual and methodological issues in research on mindfulness and meditation. *Am. Psychol.* 2015, 70, 581–592. [CrossRef]

19. Mergio, J.M.; Cancino, C.A.; Coronado, F.; Urbano, D. Academic research in innovation: A country analysis. *Scientometrics* 2016, 108, 559–593. [CrossRef]

20. Borgman, C.L.; Furner, J. Scholarly communication and bibliometrics. *Annu. Rev. Inf. Sci. Technol.* 2002, 36, 3–72. [CrossRef]

21. Wang, H.; Xu, Z.; Zeng, X.-J. Modeling complex linguistic expressions in qualitative decision making: An overview. *Knowl.-Based Syst.* 2018, 144, 174–187. [CrossRef]

22. He, X.; Wu, Y.; Yu, D.; Mergio, J.M. Exploring the Ordered Weighted Averaging Operator Knowledge Domain: A Bibliometric Analysis. *Int. J. Intell. Syst.* 2017, 32, 1151–1166. [CrossRef]

23. Lawani, S.M.J.L. Bibliometrics: Its theoretical foundations, methods and applications. *Libri* 1981, 31, 294–315. [CrossRef]

24. Yeung, A.W.K.; Goto, T.K.; Leung, W.K. A bibliometric review of research trends in neuroimaging. *Curr. Sci.* 2017, 112, 725–734. [CrossRef]

25. Sweileh, W.M.; Al-Jabi, S.W.; Sawalha, A.F.; AbuTaha, A.S.; Ziyoud, S.H. Bibliometric analysis of publications on Campylobacter. (2000–2015). *J. Health Popul. Nutr.* 2016, 35, 39. [CrossRef]

26. Mergio, J.M.; Blanco-Mesa, F.; Gil-Lafuente, A.M.; Yager, R.R. Thirty years of the International Journal of Intelligent Systems: A bibliometric review. *Int. J. Intell. Syst.* 2017, 32, 526–554. [CrossRef]

27. Mergio, J.M.; Yang, J.-B. A bibliometric analysis of operations research and management science. *Omega-Int. J. Manag. Sci.* 2017, 73, 37–48. [CrossRef]

28. Van Dam, N.T.; van Vugt, M.K.; Vago, D.R.; Schmalzl, L.; Sarson, C.D.; Olendzki, A.; Meyer, D.E. Mind the hype: A critical evaluation and prescriptive agenda for research on mindfulness and meditation. *Perspect. Psychol. Sci.* 2018, 13, 36–61. [CrossRef]

29. Zeidan, F.; Martucci, K.T.; Gordon, N.S.; McHaffie, J.G.; Coghill, R.C. Brain mechanisms supporting the modulation of pain by mindfulness meditation. *J. Neurosci.* 2011, 31, 5540–5548. [CrossRef] [PubMed]

30. Chen, C.M. Searching for intellectual turning points: Progressive knowledge domain visualization. *Proc. Natl. Acad. Sci. USA* 2004, 101, 5303–5310. [CrossRef] [PubMed]

31. Van Eck, N.J.; Waltman, L. Software survey: VOSviewer, a computer program for bibliometric mapping. *Scientometrics* 2010, 84, 523–538. [CrossRef] [PubMed]

32. Deikman, A.J. Experimental meditation. *J. Nerv. Ment. Dis.* 1963, 136, 329–343. [CrossRef]

33. Brown, K.W.; Ryan, R.M. The benefits of being present: Mindfulness and its role in psychological well-being. *J. Personal. Soc. Psychol.* 2003, 84, 822–848. [CrossRef] [PubMed]

34. Baer, R.A.; Smith, G.T.; Hopkins, J.; Krietemeyer, J.; Toney, L. Using self-report assessment methods to explore facets of mindfulness. *Assessment* 2006, 13, 27–45. [CrossRef] [PubMed]

35. Bishop, S.R.; Lau, M.; Shapiro, S.; Carlson, L.; Anderson, N.D.; Carmody, J.; Devins, G. Mindfulness: A proposed operational definition. *Clin. Psychol. Sci. Pract.* 2004, 11, 230–241. [CrossRef]

36. Hayes, S.C.; Luoma, J.B.; Bond, F.W.; Masuda, A.; Lillis, J. Acceptance and commitment therapy: Model, processes and outcomes. *Behav. Res. Ther.* 2006, 44, 1–25. [CrossRef]

37. Baer, R.A. Mindfulness Training as a Clinical Intervention: A Conceptual and Empirical Review. *Clin. Psychol. Sci. Pract.* 2003, 10, 125–143. [CrossRef]

38. Grossman, P.; Niemann, L.; Schmidt, S.; Walach, H. Mindfulness-based stress reduction and health benefits: A meta-analysis. *J. Psychosom. Res.* 2004, 57, 35–43. [CrossRef]

39. Hofmann, S.G.; Sawyer, A.T.; Witt, A.A.; Oh, D. The effect of mindfulness-based therapy on anxiety and depression: A meta-analytic review. *J. Consult. Clin. Psychol.* 2010, 78, 169–183. [CrossRef]

40. Deci, E.L.; Ryan, R.M. Self-Determination theory: A macrotheory of human motivation, development, and health. *Can. Psychol.* 2008, 49, 182–185. [CrossRef]

41. Brown, K.W.; Ryan, R.M.; Creswell, J.D. Mindfulness: Theoretical foundations and evidence for its salutary effects. *Psychol. Inq.* 2007, 18, 211–237. [CrossRef]

42. Shapiro, S.L.; Carlson, L.E.; Astin, J.A.; Freedman, B. Mechanisms of mindfulness. *J. Clin. Psychol.* 2006, 62, 373–386. [CrossRef]

43. Davidson, R.J.; Kabat-Zinn, J.; Schumacher, J.; Rosenkranz, M.; Muller, D.; Santorelli, S.F.; Urbanowski, F.; Harrington, A.; Bonus, K.; Sheridan, J.F. Alterations in brain and immune function produced by mindfulness meditation. *Psychosom. Med.* 2003, 65, 564–570. [CrossRef] [PubMed]
44. Diamond, A.; Lee, K. Interventions shown to aid executive function development in Children 4 to 12 years old. Science 2011, 333, 959–964. [CrossRef]
45. Zener, C.; Hermleben-Kurz, S.; Wulach, H. Mindfulness-based interventions in schools–a systematic review and meta-analysis. Front. Psychol. 2014, 5, 605. [CrossRef]
46. Jain, S.; Shapiro, S.L.; Swanick, S.C.; Mills, P.J.; Bell, I.; Schwartz, G.E.R. A randomized controlled trial of mindfulness meditation versus relaxation training: Effects on distress, positive states of mind, rumination, and distraction. Ann. Behav. Med. 2007, 33, 11–21. [CrossRef]
47. Chiesa, A.; Serretti, A. Mindfulness-Based Stress Reduction for Stress Management in Healthy People: A Review and Meta-Analysis. J. Altern. Complement. Med. 2009, 15, 593–600. [CrossRef]
48. Wulach, H.; Buchheld, N.; Buttenmueller, V.; Kleinknecht, N.; Schmidt, S. Measuring mindfulness—The Freiburg Mindfulness Inventory (FMI). Pers. Indiv. Differ. 2006, 40, 1543–1555. [CrossRef]
49. Lengacher, C.A.; Johnson-Mallard, V.; Post-White, J.; Moscoso, M.S.; Jacobsen, P.B.; Klein, T.W.; Widen, R.H.; Fitzgerald, S.G.; Shelton, M.M.; Barta, M.; et al. Randomized controlled trial of mindfulness-based stress reduction (MBSR) for survivors of breast cancer. Psycho-Oncology 2009, 18, 1261–1272. [CrossRef]
50. Lettus, D. Collection Development Relaxation & Meditation. Libr. J. 2010, 135, 30–32.
51. Khalsa, S.S.; Rudrauf, D.; Damasio, A.R.; Davidson, R.J.; Lutz, A.; Tanel, D. Interoceptive awareness in experienced meditators. Psychophysiology 2008, 45, 671–677. [CrossRef]
52. Garland, E.; Gaylord, S.; Park, J. The role of mindfulness in positive reappraisal. Explore-NY 2009, 5, 37–44. [CrossRef]
53. Dalen, J.; Smith, B.W.; Shelley, B.M.; Sloan, A.L.; Leahigh, L.; Begay, D. Pilot study: Mindful Eating and Living (MEAL): Components of Mindfulness. J. Child Fam. Stud. 2010, 19, 191–206. [CrossRef]
54. Weber, B.; Jermann, F.; Gex-Fabry, M.; Nallet, A.; Bondolfi, G.; Aubry, J.M. Mindfulness-based cognitive therapy for bipolar disorder: A feasibility trial. Eur. Psychiatry 2010, 25, 334–337. [CrossRef]
55. Vago, D.R.; Silbersweig, D.A. Self-awareness, self-regulation, and self-transcendence (S-ART): A framework for understanding the neurobiological mechanisms of mindfulness. Front. Hum. Neurosci. 2012, 6, 296. [CrossRef]
56. Zeidan, F.; Johnson, S.K.; Diamond, B.J.; David, Z.; Goolkasian, P. Mindfulness meditation improves cognition: Evidence of brief relaxation training. Front. Psychol. 2014, 5, 1332–1359. [CrossRef]
57. Cohen, S.; Kamarck, T.; Mermelstein, R. A global measure of perceived stress. J. Health Soc. Behav. 1983, 24, 385–396. [CrossRef]
58. Holzel, B.; Lazar, S.; Gard, T.; Schuman-Olivier, Z.; Vago, D.; Ott, U. How does mindfulness meditation work? Proposing mechanisms of action from a conceptual and neural perspective. Perspect. Psychol. Sci. 2011, 6, 537–559. [CrossRef]
59. Tang, Y.Y.; Holzel, B.K.; Posner, M.I. The neuroscience of mindfulness meditation. Nat. Rev. Neurosci. 2015, 16, 213–225. [CrossRef]
60. Gu, J.; Strauss, C.; Bond, R.; Cavanagh, K. How do mindfulness-based cognitive therapy and mindfulness-based stress reduction improve mental health and wellbeing? A systematic review and meta-analysis of mediation studies. Clin. Psychol. Rev. 2015, 37, 1–12. [CrossRef]
61. Goyal, M.; Singh, S.; Sibinga, E.M.; Gould, N.F.; Rowland-Seymour, A.; Sharma, R.; Haythornthwaite, J.A. Meditation programs for psychological stress and well-being: A systematic review and meta-analysis. JAMA Intern. Med. 2014, 174, 357–368. [CrossRef]
72. Ma, S.H.; Teasdale, J.D. Mindfulness-based cognitive therapy for depression: Replication and exploration of differential relapse prevention effects. *J. Consult. Clin. Psychol.* 2004, 72, 31–40. [CrossRef] [PubMed]

73. Khoury, B.; Sharma, M.; Rush, S.E.; Fournier, C. Mindfulness-based stress reduction for healthy individuals: A meta-analysis. *J. Psychosom. Res.* 2015, 78, 519–528. [CrossRef] [PubMed]

74. Carmody, J.; Baer, R.A. Relationships between mindfulness practice and levels of mindfulness, medical and psychological symptoms and well-being in a mindfulness-based stress reduction program. *J. Behav. Med.* 2008, 31, 23–33. [CrossRef] [PubMed]

75. Khoury, B.; Lecomte, T.; Fortin, G.; Masse, M.; Therien, P.; Bouchard, V.; Hofmann, S.G. Mindfulness-based therapy: A comprehensive meta-analysis. *Clin. Psychol. Rev.* 2013, 33, 763–771. [CrossRef]

76. Lazar, S.W. Mindfulness research. *Mindfulness Psychother.* 2005, 22, 220–238.

77. Hayes, S.; Graham, J. Decentering as a common link among mindfulness, cognitive reappraisal, and social anxiety. *Behav. Cogn. Psychoth.* 2013, 41, 317–328. [CrossRef]

78. Jha, A.P.; Krompinger, J.; Baime, M.J. Mindfulness training modifies subsystems of attention. *Cogn. Affect. Behav. Neurosci.* 2007, 7, 109–119. [CrossRef]

79. Creswell, J.D. Mindfulness interventions. *Annu. Rev. Psychol.* 2017, 68, 491–516. [CrossRef]

80. Cahn, B.R.; Polich, J. Meditation states and traits: EEG, ERP, and neuroimaging studies. *Psychol. Bull.* 2006, 132, 180–211. [CrossRef]

81. Baminiwatta, A.; Solangaarachchi, I. Trends and Developments in Mindfulness Research over 55 Years: A Bibliometric Analysis of Publications Indexed in Web of Science. *Mindfulness (NY)* 2021, 1–18. [CrossRef]