

Bibliometric Analysis of AYUSH-64: A Polyherbal Ayurvedic Formulation

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ABSTRACT With the onset of the COVID-19 pandemic, the AYUSH-64 drug gained attention as several studies related to this drug were published. A bibliometric analysis was conducted to explore the research landscape surrounding this drug before and after the pandemic using the Scopus database. Visualisations were created using VOS viewer, and Microsoft Excel was utilised to analyse the frequency of publications by authors, journals, and years, incorporating 35 articles. Pre-COVID investigations focused on infective febrile illnesses, whereas post-COVID research concentrated on molecular docking, clinical trials and public health. The Journal of Ayurveda and Integrative Medicine recorded the highest number of publications (n=9) and citations (n=108), with Thakar A being the first author with the highest number of publications (n=3). From 1991 to 2024, 14 publications were recorded in 2022. Of the total, 17.14 percent (n=6) of articles were published on non-COVID-19 related investigations before 2020, while 82.86 percent (n=29) investigated the role of AYUSH-64 in COVID-19. Most publications concentrated on the role of AYUSH-64 in COVID-19, with studies ranging from clinical trials to molecular docking.

INTRODUCTION

The COVID-19 pandemic has affected the entire globe, and its severity was unprecedented, occurring nearly a century after the Spanish flu pandemic. Scientists across the globe put in their best efforts to find solutions for this menace. A plethora of research publications were published in the areas of drug trials and vaccine trials, in addition to other aspects of the disease, such as pathophysiology and management strategies (Majumder and Minko 2021; Javaid et al. 2020). Scientific organisations and government agencies published several guidelines to manage and control the pandemic. A massive surge of literature could be seen in different scientific databases related to COVID-19 (Kambhampati et al. 2020; ElHawary et al. 2020; Yu et al. 2020; Chahrour et al. 2020). In addition to modern medicine, a lot of literature has also been published regarding the role of Ayurveda in preventing and managing COVID-19. Studies suggest that many of the Ayurveda interventions can be repurposed for the prevention and

management of COVID-19, as their traditional usage has been safe and efficacious. Furthermore, experimental studies have demonstrated the immunomodulating, anti inflammatory, antioxidant properties, and antiviral activities of Ayurveda drugs (Spelman et al. 2006; Burns et al. 2010; Roy et al. 2016; Rege and Chowdhary 2013; Sharma et al. 2012; Upadhyay et al. 2010; Maurya et al. 2020; Gandhi et al. 2022). AYUSH-64 is a polyherbal Ayurveda formulation developed by CCRAS, Ministry of AYUSH, Government of India. The efficacy and safety of this formulation have been proven effective in febrile conditions of malaria, microfilaremia, chikungunya and influenza (Bhatia 1997; Chari et al. 1982; Pandey and Kishore 1989; Central Council for Research in Ayurvedic Sciences 2009). A pilot study has proved its effectiveness in influenza-like illnesses (Gundeti et al. 2022), and a molecular docking study revealed that 35 phytoconstituents isolated from AYUSH 64 demonstrated antiviral activity against SARS-Cov-2 (Ram et al. 2022). Given this background, a bibliometric analysis was conducted to understand the research landscape of AYUSH-64 before and after the COVID-19 pandemic.

Objectives

The primary objectives of this bibliometric analysis were to evaluate the trends in publications

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concerning AYUSH-64 before and after the COVID-19 pandemic, and to identify the prominent journals and authors, including citations related to the publications on AYUSH-64.

MATERIAL AND METHODS

Bibliometric Analysis

This bibliometric analysis conducted the co-authorship analysis, year-wise publication trends, journal-wise publications, citations, and keyword clouding.

Data Sources

The Scopus search engine was utilised to extract the published literature without any filters applied. The search was conducted on May 25, 2024.

Eligibility and Study Selection

The analysis included all research articles that focused on any aspect of AYUSH-64.

Search Strategy

The “AYUSH-64” keyword was used to retrieve the articles from the Scopus database.

Analysis and Visualisation

The data were analysed using Microsoft Excel, employing pivot tables and conditional formatting to illustrate frequency distributions by year, first author, and journal. Likewise, VOSviewer (Nees Jan van Eck and Ludo Waltman, 31 October 2023) was employed to generate the visualisations (van Eck and Waltman, 2019).

RESULTS

Of the 40 articles retrieved through the Scopus database, 35 were finally included in the analysis. Figure 1 shows the bibliographic coupling of authors.

Table 1: Top five contributors of AYUSH-64 research

S. No.	Author name	Total documents	Total citations	Total link strength
1	Shrikanth Narayanam	8	102	91
2	Khanduri Shruti	4	47	47
3	Dhiman KS	3	70	42
4	Gundet Manohar	3	41	41
5	Rana Rakesh	3	46	40

Bibliographic Coupling of Authors

The top five authors with the number of documents, citations and total link strength, as retrieved from VOSviewer, are presented in Table 1. The total link strength denotes the total strength of the co-authorship links of a given researcher with other researchers. Table 2 depicts the first author-wise publications with journal names and citations, in which Thakar A. has the highest number of publications (n=3) with a total citation of 19. The author has published two research articles and one review in three journals, namely, Journal of Integrative and Complementary Medicine, Journal of Ayurveda and Integrative Medicine and Journal of Evidence-Based Integrative Medicine.

Year-wise Publications of AYUSH-64

The first publication on AYUSH-64 in the Scopus database was recorded in the year 1991, and six publications were recorded till 2016, as presented in Table 3. All these publications (n=6, 17.14%) are related to the role of AYUSH-64 in infective febrile illnesses, 4 articles focused on malaria, one each on filaria and policy and regulatory aspects of Ayurvedic drugs. Similarly, 29 other articles (82.86%) focused on COVID-19-related topics, as presented in Table 3. Post-COVID, the first two publications recorded in the Scopus database were published in “Plant Science Today” with 16 citations and “International Journal of Research in Pharmaceutical Sciences” with no citations in 2020. The year 2022 has recorded the highest number of publications (n=14) with a total citation of 132.

Journal-wise Publications

The journal-wise analysis shows that 26 different journals published 35 articles from 1991 to 2024. The Journal of Ayurveda and Integrative Medi-

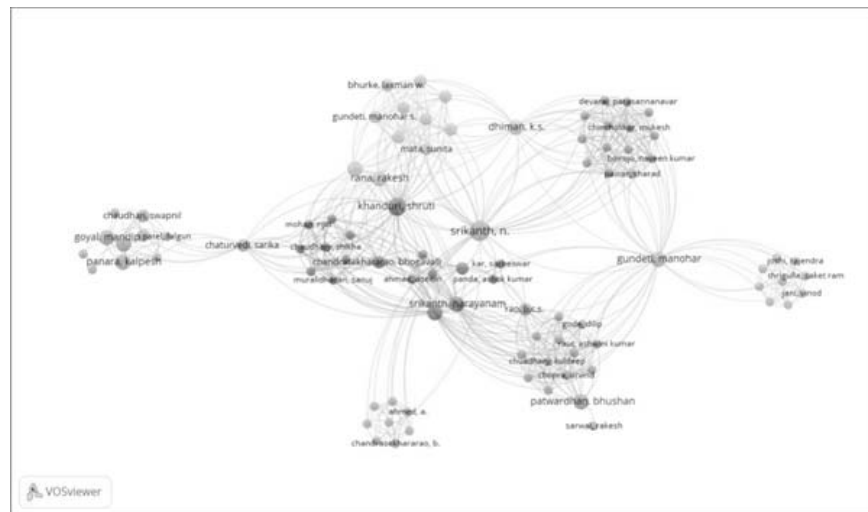


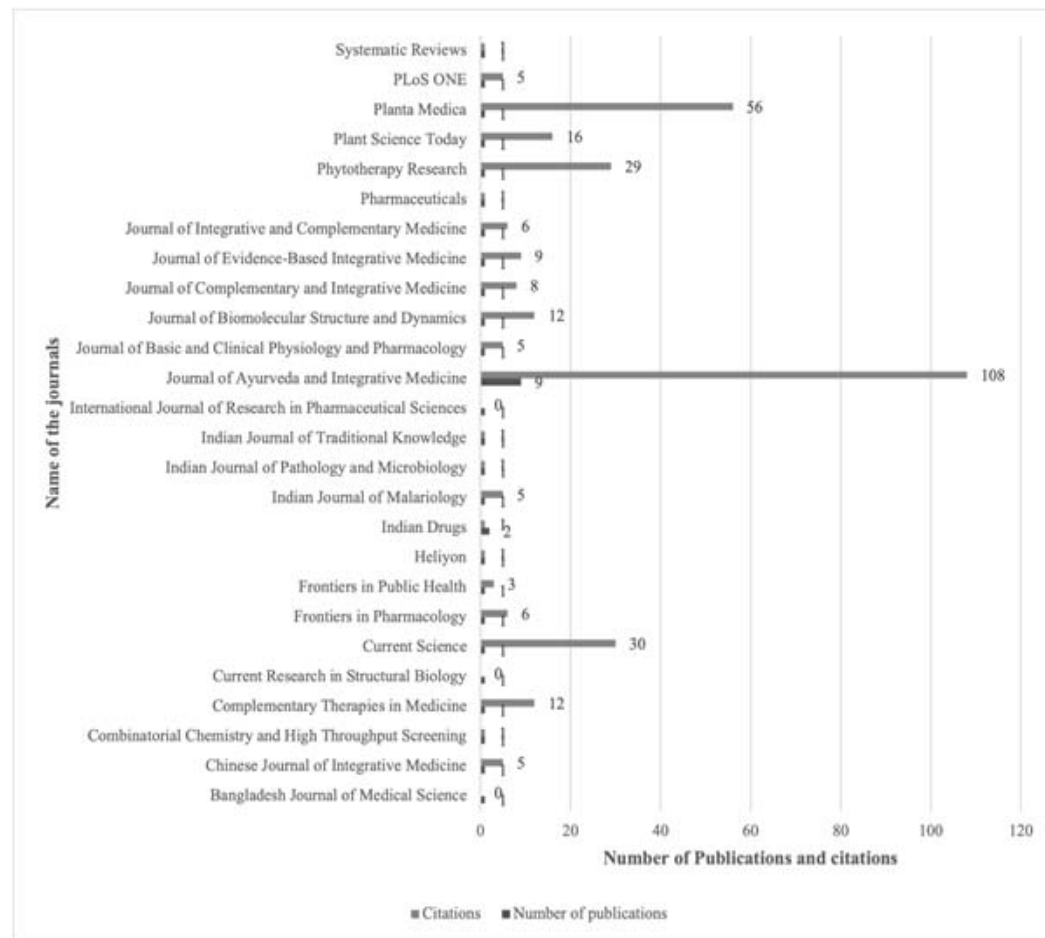
Fig. 1. Bibliographic coupling of authors

Table 2: First author-wise publications on AYUSH-64

First author	No. of articles	Name of journals	Total citations
Thakar A	3	Journal of Integrative and Complementary Medicine (n=1), Journal of Ayurveda and Integrative Medicine (n=1), Journal of Evidence-Based Integrative Medicine (n=1)	6+4+9=19
Gundeti MS	2	Journal of Ayurveda and Integrative Medicine (n=2)	34+0=34
Niraj S	2	Plant Science Today (n=1), International Journal of Research in Pharmaceutical Sciences (n=1)	16+0=16
Patwardhan B	2	Journal of Ayurveda and Integrative Medicine (n=2)	4+10=14
Rai AK	2	Indian Journal of Traditional Knowledge (n=1), BMC-Systematic Reviews	1+1=2
Ali H	1	Indian Journal of Pathology and Microbiology	1
Batta A	1	Journal of Basic and Clinical Physiology and Pharmacology	5
Chaudhari SS	1	Journal of Ayurveda and Integrative Medicine	2
Chopra A	1	PLoS ONE	5
Deshpande SJ	1	Indian Drugs	0
Jani V	1	Current Research in Structural Biology	0
Joshi C	1	Journal of Biomolecular Structure and Dynamics	12
Kasarla SS	1	Frontiers in Pharmacology	6
Kazim M	1	Indian Journal of Malariology	5
Kumari D	1	Heliyon	1
Kumari M	1	Bangladesh Journal of Medical Science	0
Makhija KC	1	Combinatorial Chemistry and High Throughput Screening	1
Mukherjee T	1	Indian Drugs	1
Panda AK	1	Journal of Ayurveda and Integrative Medicine	13
Pandey DN	1	Journal of Ayurveda and Integrative Medicine	5
Ram TS	1	Journal of Ayurveda and Integrative Medicine	36
Rizvi ZA	1	Pharmaceuticals	1
Sawant RS	1	Journal of Complementary and Integrative Medicine	8
Singh H	1	Complementary Therapies in Medicine	12
Singh RS	1	Phytotherapy Research	29
Srikanth N	1	Frontiers in Public Health	3
Upadhyay A	1	Chinese Journal of Integrative Medicine	5
Valecha N	1	Current Science	30
Willcox M	1	Planta Medica	56

Table 3: Year-wise publications of AYUSH-64

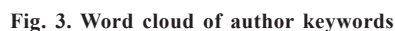
Year	1991	1994	1996	2000	2011	2016	2020	2021	2022	2023	2024
No. of publications	1	1	1	1	1	1	2	5	14	6	2
Pre-COVID-17.14%Post-COVID-82.86%											

**Fig. 2. Journal-wise publications and citations of AYUSH-64**

cine has recorded the highest number of publications ($n=9$) with a total citation of 108, as presented in Figure 2. Of the 9 publications, 4 are research articles (75 citations), 1 review (14 citations), 2 letters (5 citations) and 2 editorials (14 citations). The journal has published 6 documents in 2022 and one each in 2016, 2021 and 2023. Table 4 depicts the types of documents published on AYUSH-64

Table 4: Types of publications

Type of document	Proportion
Conference paper	2.85% ($n=1$)
Editorial	5.71% ($n=2$)
Letter	8.57% ($n=3$)
Review	20.00% ($n=7$)
Article	62.86% ($n=22$)



DISCUSSION

The bibliometric analysis conducted on AYUSH-64 research reveals a considerable number of publications concerning this drug. Although the volume of publications related to infective febrile illnesses is significantly low, substantial research exists regarding its role in COVID-19. This indicates a contrasting research trend, and the original purpose of AYUSH-64 was its application in infec-

As an Ayurvedic drug, publications about AYUSH-64 are typically expected in journals focused on Ayurveda and traditional medicinal systems. However, this expectation is not reflected in the actual publications related to this drug, both before and after the pandemic. Six articles were published before the pandemic, of which only one appeared in a journal associated with Ayurveda, namely the *Journal of Ayurveda and Integrative Medicine*. The other five were published in the *Indian Journal of Malariology*, *Indian Drugs*, *Current Science*, *Planta Medica*, and the *Indian Journal of Pathology and Microbiology*, addressing the role of AYUSH-64 in treating febrile illnesses.

The Journal of Ayurveda and Integrative Medicine emerged as the leading contributor to the AYUSH-64 publications, including one before the onset of the COVID-19 pandemic. Similarly, publications during and after the COVID-19 period regarding AYUSH-64 were found in various interdisciplinary journals, not limited to those related to Ayurveda and traditional medicine, although there was a higher volume of publications in these journals. Another bibliometric analysis of AYUSH-64, using the Dimensions database and primarily focusing on COVID-related research from 2019 to 2024, revealed that the Journal of Ayurveda and Integrative Medicine accounted for more than 10 percent of the total publications, with 64 total citations (Singh et al. 2024). Bibliometric analysis in the realm of Ayurveda is not very abundant. Research indicates a sustained increase in the publication of scholarly literature on Ayurveda, marked by significant expansion from 1993 to 2012, followed by a fall until 2019. The COVID-19 epidemic distinctly facilitated extensive study in Ayurveda, resulting in a significant increase in publications and the highest volume of articles released from 2020 to 2022, including those in prestigious journals among the top two quartiles (Nedungadi et al. 2023; Samal 2024). The year-wise analysis in this bibliometric study found that publications related to AYUSH-64 were highest in 2022, with a total of 14 publications. The cited study using the Dimensions database found that in 2021 and 2022, the highest number of articles was published on AYUSH-64 with 16 and 13 articles, respectively (Singh et al. 2024).

A clear examination of the journals reveals that only the Journal of Ayurveda and Integrative Medicine is indexed in Scopus, which is of Indian origin and dedicated to Ayurveda research. This signifies a distinct necessity for standardised and high-quality publications in the domain of Ayurveda. Affiliated Ayurveda journals linked to CCRAS and other academic institutions in India are inadequately indexed, necessitating appropriate intervention from relevant authorities to expand the dissemination of Ayurveda research to a broader audience. JAIM has the highest number of publications in the past five years, corroborated by additional research. An Altmetric Attention analysis of the literature produced from 2019 to 2023 revealed that JAIM has 10 papers with a total of 374 citations and an impact factor of 2.23 (Singh and Mansoria

2023). Furthermore, this bibliometric study discovered that Shrikanth Narayanam has the most publications, totalling eight, with 102 citations, while the Dimensions database study reported a total of 63 citations for the author (Singh et al. 2024). This bibliometric analysis found that across these 35 studies, “AYUSH-64” has been used as an author keyword 14 times, and the Dimensions database study found that the keyword “Ayush” has 35 occurrences (Singh et al. 2024). These variations may be due to differing timeframes and databases utilised in the bibliometric studies.

CONCLUSION

The bibliometric analysis found a good number of research publications on AYUSH-64. Of the total 35 articles published, six articles were published before, and 29 articles were published following the COVID-19 pandemic. However, there exists a very limited number of standard Ayurveda journals that require attention from academia. Furthermore, more research must be conducted on AYUSH-64 for which it is intended. Enhanced institutional collaboration should be promoted within the scientific domain of Ayurveda to facilitate collaborative research, utilising support from contemporary scientific communities.

RECOMMENDATIONS

The researchers make the following recommendations based on the study.

Broaden the Scope of Clinical Research on AYUSH-64

The bibliometric analysis indicated that over 80 percent of research publications are related to COVID-19 although the drug was originally intended for various febrile illnesses. Therefore, further research should be conducted to assess the efficacy of this drug on febrile and infectious diseases through well-structured clinical trials beyond COVID-19.

Significant Publications in Ayurveda

Since AYUSH-64 is an Ayurvedic drug developed by CCRAS, the analysis revealed that only one journal, the Journal of Ayurveda and Integra-

tive Medicine, contains the majority of publications, while the others are featured in interdisciplinary journals. Consequently, efforts should be made to establish more impactful Ayurvedic journals to enhance the global visibility and credibility of Ayurveda research.

Collaborative Research

Considering the multitude of research conducted during COVID-19, there should be an increase in collaborative efforts among Ayurveda experts, public health scientists, and biomedical researchers, which could aid in understanding the role of AYUSH-64 within the mainstream healthcare system.

CONTRIBUTIONS BY THE AUTHOR

Definition of intellectual content, concepts, design, literature search, manuscript preparation, data analysis, manuscript editing, and manuscript review was completed by Janmejaya Samal.

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