

Research output from India's Siddha system of medicine during 1972–2019: Bibliometric analysis points need to focus on quantity and quality

Sendhilkumar Muthappan¹, Rajalakshmi Elumalai¹, Prakash Muthuperumal², Priyanka Manivannan², Satish Sivaprakasam¹, Manickam Ponnaiah¹

¹Division of Online Courses, ICMR- National Institute of Epidemiology, Chennai, Tamil Nadu, India, ²SRM School of Public Health, SRM Institute of Science and Technology, Chennai, Tamil Nadu, India

ABSTRACT

Introduction: The Siddha system of medicine (SSM) is one of the Indian Systems of Medicine (ISM). In recent times, it has received adequate support from the Indian Ministry of Ayush. Like many such indigenous systems of medicine globally, the SSM is based on its own theoretical principles, philosophy, and methods of practice. Nevertheless, SSM conducts and needs basic and applied research using scientific methods. Such research is evidenced by research publications. In the absence of a review, we did a bibliometric analysis of research publications from SSM for the period of 1972–2019. **Materials and Methods:** We used the term “Siddha” to retrieve the data from the PubMed database. We retrieved data from the National AYUSH research portal and homepages of institutions mandated to do research in SSM. We abstracted bibliometric information and used Epi info (Version 7.2) for analysis. We described the trends and key characteristics. **Results:** Of a total of 2009 retrieved articles, we included 1457 (73%) for analysis. Between 1972 and 2001, the median number of publications per year was three (range: 0–13). Beyond 2012, the publications increased exponentially with an annual growth of 23%. The maximum number of publications ($n = 224$) was in 2019. Among 43 countries that produced the papers, India topped it (88%). Of 1457, 1.7% ($n = 25$) of publications from Siddha institutions were indexed in PubMed. **Conclusion:** A bibliometric review of research output from SSM suggests that the publications have increased in the last two decades. The review recommends improving research output from SSM in terms of quantity and quality.

Keywords: Alternative medicine, Ayush, scientometrics, Siddha, traditional medicine

Introduction

Traditional medicine is defined as an amalgamation of knowledge, skill, and practices based on theories, beliefs, and experiences indigenous to different cultures, whether explicable or not, used for therapeutic, restorative, prevention, diagnosis, and

maintenance of physical and mental health.^[1,2] Ayush is the acronym that collectively refers to traditional medical systems that are being practiced in India such as Ayurveda, Yoga and Naturopathy, Unani, Siddha, and Sowa-Rigpa and Homeopathy. These systems are based on definite medical philosophies and represent a way of healthy living with established concepts on the prevention of diseases and the promotion of health. The traditional medical systems of India were given departmental status under Department of Indian Systems of Medicine and Homeopathy (ISM and H) by the Indian Ministry of Health and Family Welfare in March 1995.. This was later rechristened as the

Address for correspondence: Dr. Manickam Ponnaiah, ICMR-National Institute of Epidemiology, R 127, TNHB, Ayapakkam, Chennai - 600 077, Tamil Nadu, India. E-mail: manickam@nie.gov.ins

Received: 02-10-2023

Revised: 08-12-2023

Accepted: 08-02-2024

Published: 11-09-2024

Access this article online

Quick Response Code:



Website:

<http://journals.lww.com/JFMPC>

DOI:

10.4103/jfmprc.jfmprc_1623_23

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

For reprints contact: WKHLRPMedknow_reprints@wolterskluwer.com

How to cite this article: Muthappan S, Elumalai R, Muthuperumal P, Manivannan P, Sivaprakasam S, Ponnaiah M. Research output from India's Siddha system of medicine during 1972–2019: Bibliometric analysis points need to focus on quantity and quality. J Family Med Prim Care 2024;13:3608-13.

Department of AYUSH in November 2003. On 9th November 2014, the Government of India created an independent Ministry of Ayush to ensure the optimal development and propagation of AYUSH systems of healthcare.^[3] The focus given to ISM has been remarkably increasing throughout recent planning commissions of the Government of India. This federal support covers strengthening the quality of education, strategic research programs, best clinical practices and setting internationally acceptable pharmacopeia standards and better utilization of the Ayush workforce in the national health programs.^[4] These amendments and strategies were streamlined and implemented through regulatory bodies, national institutes and research councils for each of the Ayush systems. These medical systems are now an integral part of the umbrella of all the healthcare programs implemented through India's National Health Mission (NHM).^[5]

Siddha system of medicine (SSM) is one of the ISM similar to Ayurveda medicine in its basic concepts. It is being practiced majorly in the state of Tamil Nadu and Tamil-speaking regions of India and worldwide.^[6] The SSM education and practice were regulated by an autonomous body called the Central Council of Indian Medicine (CCIM). In 2021, the CCIM was replaced by National Commission for Indian System of Medicine (NCISM). The research in the SSM is governed and led by the Central Council for Research in Siddha (CCRS) under the Ministry of Ayush. The National Institute of Siddha (NIS) is a flagship institute dedicated to research and postgraduate education in SSM.^[7,8] The CCIM/NCISM has approved 5.5-year undergraduate degree [awarded as Bachelor of Siddha Medicine and Surgery (BSMS)] and 3-year postgraduate [MD (Siddha)] programmes. In 2024, a total of 1,490 BSMS seats are offered through 16 medical colleges (three in Government and 13 in the private sector) in Tamil Nadu. One undergraduate medical college is located in Kerala State.^[9] MD degree is offered at two Government medical colleges ($n = 94$) and at NIS ($n=46$). Recent reforms in SSM education include bringing research methodology into both teaching and practice.^[10] The total faculty strength in these institutions may be more than 300. From the consumer angle, the utilization of AYUSH systems is estimated to be very low (about 7% of outpatient care) when compared to some of the previous estimates or general perceptions as estimated by India's National Sample Survey (NSS) 2014.^[11] There are many reasons for less utilization of the research for Ayush in India. However, the budget allocation for health in India is steadily increasing. Total budget allotted to the Ministry of Ayush increased by 20% in 2023 from the previous year.^[12] Users demand evidence of safety and efficacy of these systems of medicine owing to the present-day focus on evidence-based medicine. Hence, increased budgetary allocation could potentially improve the research, evidence-base and thereby utilization of Ayush in India.^[13]

Such evidence must be generated through systematic research by various stakeholders. Health research is as important as clinical knowledge and clinical service. Health research has high value to society as it presents significant information concerning disease trends and risk factors, outcomes of treatment, public

health interventions, patterns of care, and healthcare costs.^[14] The process of research is incomplete until proper scientific communication is made with the peer group and community. In this context, bibliometrics is used to gauge such research output. Bibliometrics is a process of extracting measurable data through statistical analysis of published research studies. The focus of bibliometrics is to evaluate how the knowledge within a publication is used.^[15] This is one of the key methods to measure the impact of scholarly publications objectively.^[16] In view of the increasing patronage accorded to the Ayush systems, the research contributions are expected to be commensurate with that of the size and distribution of the Ayush sector engaged in research, education, and practice. However, according to published reports Ayush research publications are limited except from the Ayurveda system.^[12,17] In this context, we reviewed scientific publications in SSM through bibliometric analysis from 1972 to 2019. We characterized the research outputs in SSM by year of publication, place and institutional affiliation of the authors, nature of the journal, and type.

Materials and Methods

Study design

This was a cross-sectional study

Data sources

We considered the databases of PubMed, the Ministry of AYUSH research portal meant as a repository of evidence-based research data of Ayush systems at the global level (ayushportal.nic.in) and home pages of research institutions of CCRS and NIS.

Study selection

We used the key term "Siddha" in the PubMed electronic database to retrieve Siddha's research articles. We abstracted the required information from research papers listed under "Siddha medical system" in the Ayush research portal. We retrieved research papers listed under the research and publication category in the portals of CCRS and NIS.

Selection criteria

We included cross-sectional studies, case studies, case series, cohort studies, randomized controlled studies, non-randomized controlled studies, quasi-controlled studies, and systematic reviews. We included research articles in the English language from both indexed and non-indexed journals. We did not restrict with regards to geographical location, type of research and institutions. We excluded the books, book chapters, book series, and papers presented at workshops, conferences, and seminars.

Data extraction

We downloaded the data in the Excel format from PubMed. We used Excel to enter the data from the Ayush research portal and research institutions. We used data abstraction form to retrieve information on the title of the research article, the name of the

journal, the indexing status of the journal, the name and place of institutional affiliation of the corresponding author, the research category (as categorized in the Ayush research portal) and the year of publication. Two independent reviewers abstracted the data. Reviewers manually checked all the extracted titles and abstracts for the relevant and required information. We cleaned the data and coded it before analysis. The research articles that are not related to Siddha were removed from the analysis. The duplicate articles were removed and analyzed. A third reviewer sorted out any conflict between these two reviewers regarding the decision to include a research article.

Data analysis

We did the descriptive analysis such as the trend of publications, most productive countries, top journals that published more articles, articles published in PubMed, and type of publications. We provided descriptive statistics of the research output in terms of proportions, median, and range. We described trends in publication trends over time and that of geographical distribution. Indexing in PubMed was considered to reflect the quality of publication, and therefore, we calculated the proportion of research publications in the PubMed database. We used Epi-info (version 7.2) and Quantum GIS (QGIS) applications for analysis.

Results

We retrieved 2009 articles from the databases and institutions, and 1457 (73%) of them were included for final analysis after removing the non-relevant and duplicates [Figure 1]. We analyzed the trend of the publications also. The median number of publications per year between 1972 and 2001 was three (range: 0–13). Beyond 2012, the publications increased exponentially with an annual growth of 23%. The number of publications was on an upward trend after 2000. The maximum number of publications ($n = 224$) was in 2019 [Figure 2]. The research

outputs were contributed by researchers from both outside the Siddha institutions/stakeholders and inside the Siddha institutions. Publications from Siddha institutions focused on fundamental and drug research, whereas those outside the SSM focused on clinical and preclinical research [Figure 3]. We identified that 43 countries published the articles. Among the 43 countries from where SSM research publications had been reported, the majority (88%, $n = 1270$) was from India followed by the USA (1.8%, $n = 26$) and China (1.3%, $n = 19$). Egypt, Indonesia, and Sri Lanka were the least published countries (0.7%, $n = 7$) [Table 1].

We also analyzed India state-wise. In India, almost all the states published the articles. In India, the Tamil Nadu state contributed the maximum number of SSM research publications (67%) followed by Karnataka and Andhra Pradesh [Figure 4]. Siddha's research articles were published in 483 journals by various publishers and countries. Of the total research papers, the top 10 journals contributed to 29% ($n = 419$) of the research

Table 1: Distribution of published research output from India's Siddha system of medicine by Countries, 1972-2019

Country	Number of publications	Percentage
India	1270	87.8
USA	26	1.8
China	19	1.3
Malaysia	12	1.0
Bangladesh	8	0.5
South Korea	8	0.5
Thailand	8	0.5
Egypt	7	0.5
Indonesia	7	0.5
Sri Lanka	7	0.5
Other countries	85	5.1

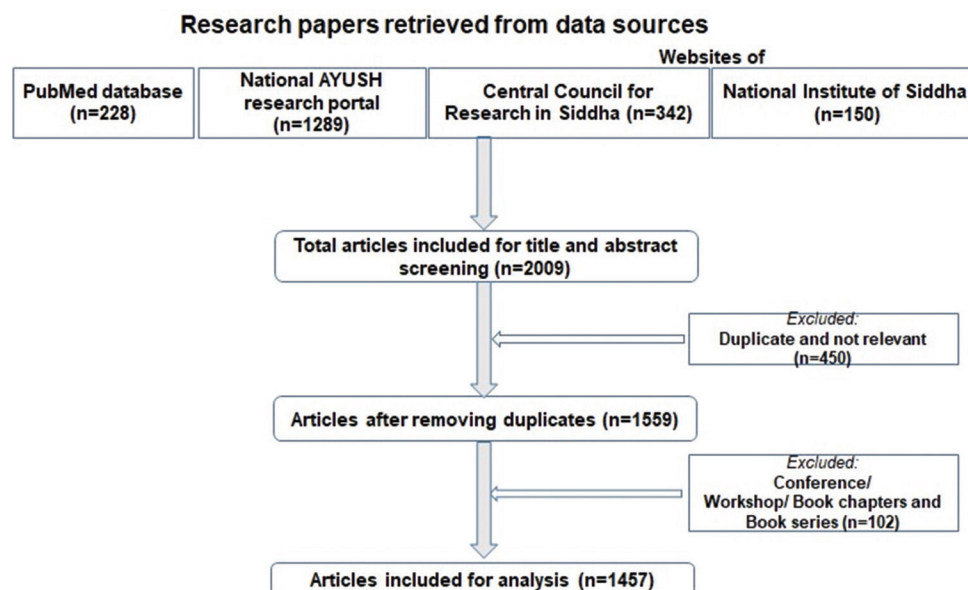


Figure 1: Bibliometric analysis of research output from India's Siddha system of medicine, 1972–2019

articles. Of these top 10 journals, pharmaceutical journals were in the top three, and seven were from India. Regarding the publishers, one journal was published by WJPR Tara Pal, one from Elsevier, one from Hindawi, and one from Wolters Kluwer-Medknow [Table 2]. Relatively more articles (23%, $n = 134$) from institutes other than Siddha were indexed in PubMed as compared to (1.7%, $n = 25$) that of the articles from Siddha research institutes [Figure 5].

Discussion

We did a bibliometric analysis research output from India's SSM for the period of 1972–2019. We documented the rapid growth of research publications in the recent two decades. While the increase in quantity is noticeable, the quality of the papers needs improvement since the majority of the papers were not published in indexed databases. The pace of the research output from SSM was so evident and can be correlated with the developments over the years. The increase in the quantity

of research output correlated with the establishment of the AYUSH department (2003), NIS (2004), CCRS (2010), Ministry of AYUSH (2013), and subsequent recognition of CCRS as a Scientific and Industrial Research Organization (SIRO)^[18] by the Ministry of Science and Technology (2014). The establishment of institutions mandated to do research in the Siddha system contributed to the gradual increase in research papers over time. In fact, we observed that nearly half of the research publications were from Siddha research institutions. The location of Siddha academic and research institutions in the state of Tamil Nadu explains the reason for the maximum number of publications from Tamil Nadu followed by the other South Indian states such as Karnataka and Andhra Pradesh.

The major concern about SSM research output is that of quality. Many researchers end up publishing in low-quality journals. The top 10 journals in which one-fourth of the SSM research outputs appear to have many poor-quality journals. The majority of these journals were pharmaceutical-related and were from India. Hence,

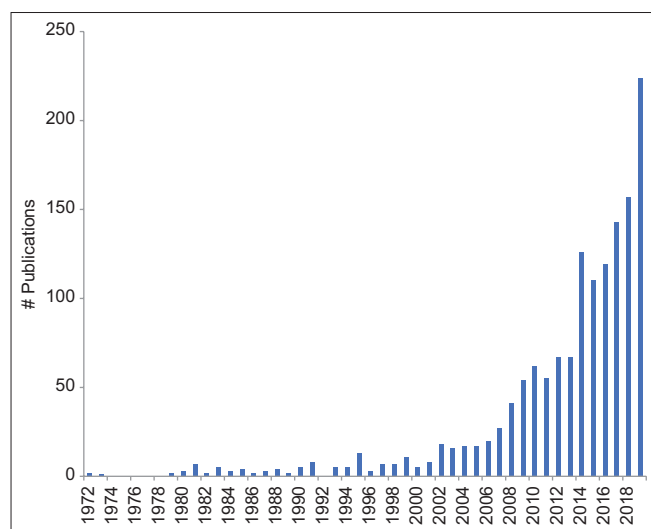


Figure 2: Frequency of research publications from India's Siddha system of medicine by year, 1972-2019

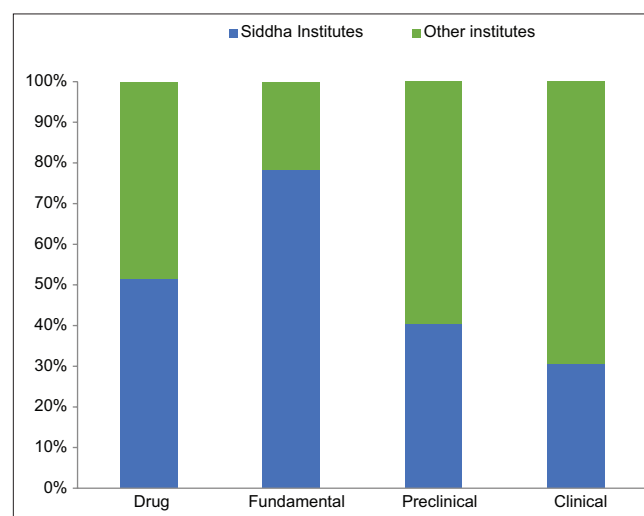


Figure 3: Distribution of research publications by type of research from India's Siddha system of medicine, 1972-2019

Table 2: Publications from India's Siddha system of medicine by top 10 journals, 1972-2019

Name of the journal (rank)	Country	Publisher	No. of articles (%)
World Journal of Pharmaceutical Research (#1)	Bulgaria	WJPR Tara Pal	76 (5.2)
International Journal of Pharmaceutical Sciences and Research (#2)	India	ShashiAlok	69 (4.7)
International Journal of Chemical and Pharmaceutical Sciences (#3)	India	Pharma Research Library	60 (4.1)
Journal of Ethnopharmacology (#4)	Netherlands	Elsevier	51 (3.5)
Journal of Research in Ayurveda and Siddha (#5)	India	Central Council for Research in Ayurvedic Sciences	47 (3.2)
Evidence-Based Complementary and Alternative Medicine (#6)	United States	Hindawi Publishing Corporation	28 (1.9)
Ancient Science of Life (#7)	India	Wolters Kluwer-Medknow	25 (1.7)
Journal of Applied Pharmaceutical Science (#8)	India	MediPoeia	25 (1.7)
Asian Journal of Pharmaceutical and Clinical Research (#9)	India	Asian Journal of Pharmaceutical and Clinical Research	20 (1.3)
International Journal of Research in Ayurveda and Pharmacy (#10)	India	Moksha Publishing House	18 (1.2)

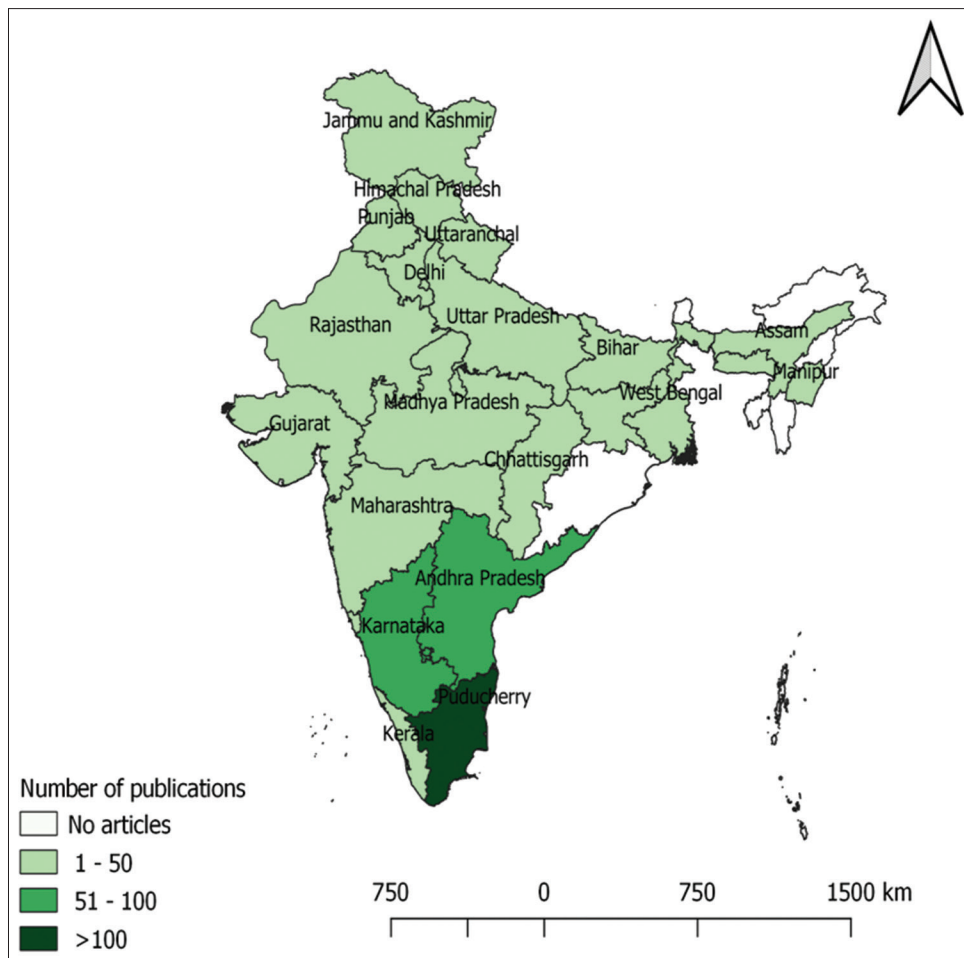


Figure 4: Distribution of research output from India's Siddha system of medicine by Indian states, 1972-2019

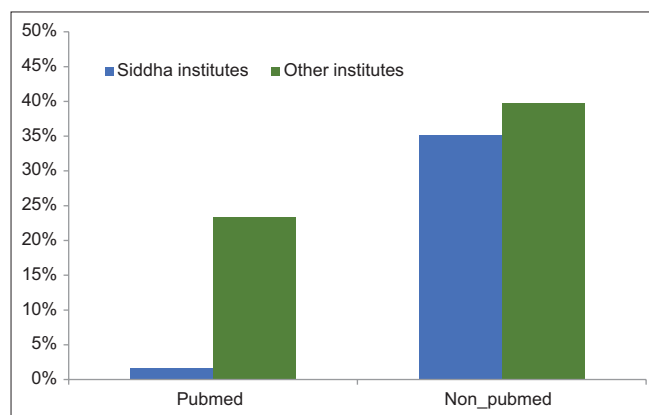


Figure 5: Distribution of research output from India's Siddha system of medicine by database and institutes, 1972-2019

most of the publications were in either low-quality or presumably predatory journals. As a matter of fact, Patwardhan *et al.*^[19] have flagged that most of the journals publishing Ayush research are found to be predatory. Researchers and academicians tend to publish in predatory journals for rapid publication, gaining employment and promotion, obtaining grants, and expecting further research opportunities.^[19-23] Aggarwal *et al.*^[24] insisted on the importance of educating and creating awareness on

highlighting the demerits of publishing in predatory journals to the postgraduate students, young researchers, and faculty members to improve the quality of research publication by publishing in legitimate peer-reviewed indexed journals.^[24] To improve the credibility of research publications, as cited above rigor in research methods is now part of the curriculum as per the CCIM regulations.^[10]

Further, in 2018, India's statutory body for university education, the University Grants Commission (UGC) established the Consortium for Academic and Research Ethics (CARE). The UGC-CARE published a list of journals called "UGC-CARE Reference List of Quality Journals (UGC-CARE List)" including journals from all disciplines indexed in globally accepted databases.^[25] The CCIM joined UGC-CARE as a member and recommends that Ayush institutions use the list for publication. These developments might pave the way for quality improvements in research output from SSM in the near future. Many scholars have indicated the lack of evidence in the Ayush and SSM as the primary concern. Lack of scientific evidence is considered as one of the major barriers for not integrating with modern medicine and thus leads to poor clinical management and patient welfare. Hence, generating strong evidence from quality research will be

useful for Siddha primary care physicians to manage the diseases effectively. The quality of research will also improve the clinical practice of physicians by identifying new methods, treatments, and technologies for effective management in clinical settings. In conclusion, this bibliometric review of the research output documents uptrend performance in the last two decades at the same time most of them published in non-PubMed journals.

Our review could suffer from two limitations. With regard to quantity, we did not search in other major databases such as Scopus, Web of Science, and IndMed and those in other language journals. Therefore, we might have underestimated the quantity. Secondly, we considered indexing in PubMed as an indicator of the quality of the published work. By not consulting other indexed databases, we could have underestimated the quality of publications. However, our analysis provides a reasonable landscape of the publications from the Siddha system. Hence, the overall direction of the findings regarding quantity and quality may not be drastically different had we done a comprehensive search beyond PubMed. Nevertheless, further studies using all key databases including those of those in regional languages may help in estimating the extent of such underestimation. In view of the findings, we recommend that research output from India's traditional SSM be published more and more in peer-reviewed and indexed journals to improve the credibility and accessibility of research.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

- World Health Organization. WHO traditional medicine strategy: 2014-2023. Genève: WHO; 2013. Available at: <https://www.who.int/publications/i/item/9789241506096> [Last accessed on 2023 Dec 06].
- World Health Organization. General Guidelines for Methodologies on Research and Evaluation of Traditional Medicine. World Health Organization; 2000. http://apps.who.int/iris/bitstream/10665/66783/1/WHO_EDM_TRM_2000.1.pdf. [Last accessed on 2023 Dec 06].
- Govt of India. Ministry of Ayush. Available at: <https://ayush.gov.in/>. [Last accessed on 2023 Dec 6].
- Samal J. Situational analysis and future directions of AYUSH: An assessment through 5-year plans of India. *J Intercult Ethnopharmacol* 2015;4:348-54.
- National Rural Health Mission: Meeting People's Health Needs in Rural Areas. Framework for Implementation: 2005-2012. New Delhi: Ministry of Health and Family Welfare: Government of India. 2012.
- Subbarayappa BV. Siddha medicine: An overview. *Lancet* 1997;350:1841-4.
- Govt. of India. Ministry of Ayush. Central Council of Indian Medicine. Available at: <https://www.ccimindia.org.in/>. [Last accessed on 2023 Dec 07].
- Govt. of India. Ministry of Ayush National Institute of Siddha. Available at: <https://nischennai.org/main/> [Last accessed on 2023 Jan 31].
- The Tamil Nadu Dr. M.G.R. Medical University. Available at: <https://www.tnmgrmu.ac.in/> [Last accessed on 2023 Dec 07].
- Govt. of India. Ministry of Ayush. Central Council of Indian Medicine. Available at: <https://ccimindia.org/pdf/SYLLABUS%20MD%20SIDDHA%20-POTHU%20MARUTHUVAM%202017.pdf>. [Last accessed on 2023 Dec 07].
- Rudra S, Kalra A, Kumar A, Joe W. Utilization of alternative systems of medicine as health care services in India: Evidence on AYUSH care from NSS 2014. *PLoS One* 2017;12:e0176916.
- Govt of India. Invest India. India is the 2nd largest exporter of Ayurveda and alternative medicine globally. Available at: <https://www.investindia.gov.in/sector/ayush>. [Last accessed on 2024 Mar 17].
- Government of India. Ministry of Health and Family Welfare, Department of ISM and H National Policy on ISM and H-2002. New Delhi. 2002.
- Nass SJ, Levit LA, Gostin LO, Institute of Medicine (US) Committee on Health Research and the Privacy of Health Information: The HIPAA Privacy Rule. 2009.
- Agarwal A, Durairajanayagam D, Tatagari S, Esteves SC, Harlev A, Henkel R, *et al.* Bibliometrics: Tracking research impact by selecting the appropriate metrics. *Asian J Androl* 2016;18:296-309.
- Kolowich S. New Measures of Scholarly Impact. Inside Higher Ed. Available from: <https://www.insidehighered.com/news/2010/12/17/new-measures-scholarly-impact>. [Last accessed on 2023 Dec 06].
- Chandra S. Status of Indian medicine and folk healing: With a focus on integration of AYUSH medical systems in healthcare delivery. *Ayu* 2012;33:461-5.
- Govt. of India. Ministry of Ayush. Central Council for Research in Siddha. Available at: <http://siddhacouncil.com/aboutus/#:~:text=Central%20Council%20for%20Research%20in%20Siddha%20is%20recognized%20as%20a,Government%20of%20India%20from%2021.08>. [Last accessed on 2023 Dec 06].
- Patwardhan K, Tillu G, Jadhav PM. Good practices of publishing AYUSH research: A practical checklist for authors. *J Ayurveda Integr Med* 2017;8:132-36.
- Beall J. Scholarly Open Access: Critical analysis of scholarly open. access publishing. *Pridobljeno*. 2013;27:2014.
- Sharma H, Verma S. Predatory journals: The rise of worthless biomedical science. *J Postgrad Med* 2018;64:226-31.
- Ferris LE, Winker MA. Ethical issues in publishing in predatory journals. *Biochem Med (Zagreb)* 2017;27:279-84.
- Muthappan S, Elumalai R, Ponnaiah M. 'Recognized journals' in guidelines from Central Council of Indian Medicine on research publications needs specification. *J Ayurveda Integr Med* 2018;9:319-20.
- Aggarwal R, Gogtay N, Kumar R, Sahni P, Indian association of medical journal editors. the revised guidelines of the medical council of india for academic promotions: Need for a rethink. *Indian J Urol* 2016;32:1-4.
- University Grants Commission. Consortium for Academic and Research Ethics. Available from: <https://ugcare.unipune.ac.in/apps1/home/index>. [Last accessed on 2023 Jan 31].