

AYUSH Research Portal: matching traditional Indian knowledge with modern needs

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Indexing is a mandatory requirement for the sustenance and progress of any scientific discipline. The AYUSH Research Portal (ARP) (<https://ayushportal.nic.in/>) is meant exclusively for indexing and dissemination of research findings in the domain of Ayurveda, Yoga and Naturopathy, Unani, Siddha, Sowa-Rigpa and Homeopathy (AYUSH) and allied faculties. By 2010, despite the availability of up to 45 databases catering to complementary and alternative medical systems, none was dedicated to index-based search on the literature of AYUSH systems. Though PubMed remained a vast storehouse, limited indexation of AYUSH journals left searches incomplete. To address this problem, a dedicated portal on AYUSH systems was developed with an exclusive focus on bringing research findings in a relatable, user-friendly manner by providing for search using International Classification of Disease-10 terms and International Classification of Primary Care classification while at the same time preserving the ontological nuances of these systems. This endeavour over a decade has resulted in a portal housing more than 30,000 articles with a good reception among the scientific community. We discuss the evolution of the concept and steps involved in the development and sustenance of ARP. We list further steps required to develop the portal into a global treasure house.

Keywords: Complementary and alternative medical system, indexing, modern medicine, research portal, traditional knowledge.

THE AYUSH Research Portal (ARP) was launched in May 2011 by the Government of India (GoI)¹. It is a one-stop portal for storage, retrieval and dissemination of curated research findings (pre-clinical, clinical, fundamental and drugs) in the Indian systems of medicine, namely Ayurveda, Yoga and Naturopathy, Unani, Siddha, Sowa-Rigpa and Homeopathy (AYUSH) searchable by both AYUSH disease terminologies, and International Classification of Diseases (ICD)² of modern medicine. ARP helps showcase research findings in an organized manner, avoiding duplication of work, encouraging interdisciplinary research and generating evidence for wider acceptance globally of traditional Indian systems of medicine. Ten years after its launch, the team behind ARP traces its origin, development, current status and suggests the way forward.

Need of AYUSH research portal

The primary function of standard library cataloguing systems has been to classify knowledge into searchable units and making them available to the user through suitable

indexing. Earliest databases on medicine began with the Medical Literature Analysis and Retrieval System (MEDLARS) at the National Library of Medicine. It was the first major machine-readable database and batch retrieval systems for bibliographical indexing way back in 1960 (ref. 3).

With the advent of information technology, efforts have moved from manual indexing to electronic databases, which are an integrated collection of logically related records or files consolidated into a common pool that provides data for multiple uses. The availability of PubMed in 1996 allowed easy electronic search and retrieval of scientific journal articles related to medical science⁴.

In 2010, Boehm *et al.*⁵ identified 45 databases dealing with complementary and alternative medicine (CAM). Of these, only one active database was from India that covered herbal therapies and none was devoted to any of the AYUSH systems. Many researchers highlighted the difficulty in conducting literature reviews in Ayurveda^{6,7}. The problems encountered in literature reviews in AYUSH disciplines include the following: (i) Language barrier of the source materials which are mostly in Sanskrit, Arabic Persian or Tamil, written in various scripts. (ii) Printed versions are yet to be digitized or machine readable, as optical character recognition compatibility for various

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Indic languages is poor and inaccurate. (iii) Availability of sizable information in Indic vernacular translations with few people available to correctly decipher them. (iv) Lack of database to provide information on both the primary sources and research works based on the same. This gap had to be addressed immediately to disseminate the available knowledge worldwide in different systems of AYUSH and to encourage collaborative research.

Further, prior to 2010, published literature on AYUSH in electronic form was scanty and scattered with limited open access. Most of the works were in hardbound print form, often locked in libraries and private collections and overtly guarded by copyright making it difficult for researchers and other stakeholders to access them or utilize the available knowledge for clinical application, research or taking policy decisions. The situation relating to research articles was far more precarious. The Research Councils in different AYUSH systems did print in-house journals; however, these were not available in electronic form, or shared with sister Research Councils on any common platform for collaboration.

PubMed was already indexing many articles from AYUSH streams in journals indexed with it. However, the limitation was few journals on Indian systems of medicine were indexed in PubMed. A large number of the already published literature in print remained out of its purview. For example, in *Aryavaidyan*⁸ published by Aryavaidyashala, Kottakkal, Kerala, is available only in print form and not indexed in PubMed to date⁸.

Further, most of the texts on AYUSH systems are from classical literature in Sanskrit, Arabic or Tamil. Besides, challenges of drug standardization, conduct of pre-clinical and clinical studies, safety-cum-efficacy studies for plant- and mineral-based formulations and yoga practices throw up unique challenges which require a customized presentation of research studies. No such facility to view unique dimensions of research in AYUSH systems was then available.

Standardization of therapies and treatments of traditional medicine is fundamental to their global acceptance^{9,10}. While considerable work has been done in this area, much remains to be done for AYUSH systems.

Design of AYUSH portal

While designing ARP, our vision was to develop a portal which could showcase literature and research publications pertaining to AYUSH system and modern system of medicine on a single dashboard. This would help Research Councils, national institutions under the Department of AYUSH and researchers in general to identify promising areas, be informed of the strengths of other sister systems of medicine and conduct collaborative research.

In this regard, we drew inspiration from the efforts of the World Health Organization (WHO) in coordination with Department of AYUSH to bring in essential elements

for standardizing CAM. These included 'standardized terminologies for Ayurveda, Siddha and Unani' through WHO Country Office, India¹¹; development of benchmark documents, etc. However, there was no tool to view AYUSH therapies and research findings by International Family of Classifications of conditions, namely International Classification of Diseases (ICD-10) (ref. 12), or International Classification of Primary Care (ICPC)¹³.

Designing a common electronic dashboard for indexing literature on different AYUSH systems offered a great opportunity to bring together all these systems, along with researchers in these domains, to work for a larger goal to find solutions for hard-to-treat conditions. Since this was a pioneering effort, there was a lot of interest among the Research Councils and support from the top management.

A brainstorming session followed with a few departmental organizations to develop a blueprint. Among them, the National Institute of Indian Medical Heritage (NIIMH), Hyderabad of the Central Council for Research in Ayurveda and Siddha was assigned the task to plan the proposed Ayurveda research database. After due consultations with experts in other Councils, a dashboard was first designed to allow search by systems besides Ayurveda, viz. Siddha, Unani, Yoga and Naturopathy, Homeopathy and Sowa-Rigpa. In late 2010, the idea was presented before S. Jalaja, the then Secretary who immediately approved it.

A crack team in Central Council for Research in Ayurvedic Sciences (CCRAS) was formed, under the leadership of one of the present authors (T.S.R.), which worked to develop the portal and hosted it on the National Informatics Centre (NIC), Hyderabad platform (<https://ayushportal.nic.in/>) within a span of six months. The exceptional commitment of late R. Rajasekaran (NIIMH) is worth mentioning here. He was the main architect of the software design, who coded the entire application following a strict timeline.

After completion of the beta version of the portal, a detailed presentation was made before Anil Kumar, the Secretary, Department of AYUSH, and the application was launched in May 2011.

Key features

The primary scope of ARP is to index⁴ high quality articles in the domain of AYUSH from offline and online journals rather than all articles in indexed journals per se. Instead of automatic inclusion of few articles from indexed journals, articles are selected based on their scientific merit. An assessment of research quality and worthiness for inclusion is done by teams of experts drawn from the respective AYUSH Research Councils. The workflow was designed in such a way that four Research Councils (Ayurveda, Yoga and Naturopathy, Unani, Siddha), and national institutions, viz. Institute of Post Graduate Training, Research in Ayurveda (IPGT&RA), Jamnagar; National

Institute of Ayurveda, Jaipur; National Institute of Unani, Bengaluru; National Institute of Homeopathy, Kolkata and National Institute of Naturopathy, Pune, participated in populating and updating the data. They have exclusive credential-based access to the system. Under each Research Council, editorial committees were constituted for maintaining high standards in selecting and presenting research material. Experts from different streams worked together on a common dashboard exhibiting great solidarity and synergy.

The inclusion criterion for an article is that the topic is related to at least one of the AYUSH systems of medicine. A unique feature of ARP is not the reputation or status of the journal, but the content of the article which after selection is put to a rigorous review by select editorial team. The article is indexed only after the editorial team is satisfied about its inclusion. As of now 535 journals are being indexed, from which articles pertaining to AYUSH are scrutinized and after vetting for suitability, included in ARP.

Articles in ARP were separately indexed for title of the article, name of the author(s), journal(s) name, institution/department and abstract. A few journals are indexed, from which all articles are automatically included in ARP. Each indexed article is given a unique six-digit identification number, clicking on which leads the user to the page displaying complete information, including its downloadable link and URL.

The architecture of ARP was designed to enable cross-discipline search for any medical condition. The portal displays information under the following ten headings: Standard treatment guidelines, Preventive promotive health, Preclinical and clinical studies, Literary and fundamental research, Drug standardization, Local health traditions, Drug monographs, Formulary of India and other formularies, References from classical textbooks and Plant monographs.

The homepage of ARP displays summary information on the total number of articles indexed for each medical system (totalling 31,983 as on 18 July 2021), which is further divided into categories of clinical research (numbering 5751), pre-clinical research (13,181), drug research (7961) and fundamental research (5091).

The information provided is categorized according to individual AYUSH systems against a standard set of medical conditions, based on WHO disease classification (ICD-10)¹², and navigation is provided according to 16 body systems in ICPC¹³.

The portal also allows advanced search using a string for any medical system by any category. Users can query the database for any AYUSH system, body system, disease condition using ICD code or perform a simple string-based Boolean search. It is also possible to search by the name of the medical condition according to the AYUSH systems, which further aids in the ease of retrieval. On

selection of the displayed results, the user gets information in the form of an abstract, and full text of the article, wherever openly available.

A vital value addition of the portal is categorization of clinical research into grades A, B and C based on 'General guidelines for methodologies on research and evaluation of traditional medicine' by WHO¹⁴. The grading allows researchers and policy-makers to assess the current R&D status of AYUSH and plan further studies to fill in the gaps.

ARP allows for cataloguing of published books based on original manuscripts and extra-mural research project reports. Most viewed and downloaded articles, recently uploaded articles and the number of users online at any point of time are displayed on the portal.

ARP is available as an open-access repository and visitors can provide valuable feedback through the stipulated e-mail id ayushportal-ccras@gov.in to the team. By 18 July 2021, the portal recorded 742,020 visitors as well as 31,983 articles with 560,386 views and 107,394 downloads.

The salient features of ARP are:

- Bridging the language barrier by making content of publications in classical or local languages available in English, and also using standard medical terminologies. This ensures wider availability of AYUSH research findings for further exploration by researchers.
- Contents are searchable by category (AYUSH systems, disease name, etc.).
- Free-flowing search (using keywords/random word search).
- Linkages with ICD-10 and further stratification with the categories of ICPC for improving clinical relevance.
- Grading clinical research articles into A, B or C based on the 'General guidelines for methodologies on research and evaluation of traditional medicine' by WHO.
- Unique collection from legacy print versions of articles to electronic versions available recently.
- Expert-driven (in terms of sourcing articles, vetting and indexing).
- Application hosted on secure government cloud (NIC) with redundancy and built-in security.
- Publicly funded and open access.

The portal Digital Helpline for Ayurveda Research Articles (DHARA) was developed in 2012 (ref. 7). It provides a free indexing service for papers published in research journals in the field of Ayurveda. Like ARP, DHARA provides a powerful search tool to track research articles in Ayurveda. Both ARP and DHARA have been promoted and funded by the Ministry of AYUSH. Table 1 presents a comparison of the scope of PubMed, DHARA and ARP.

GENERAL ARTICLES

Table 1. PubMed, DHARA Portal and AYUSH Research Portal

Features	PubMed	DHARA Portal	AYUSH Research Portal
Scope of indexing	Articles of medical importance (animal/plant, etc.)	Ayurveda articles only	Ayurveda, Yoga and Naturopathy, Unani, Siddha, Sowa-Rigpa and Homeopathy (AYUSH) articles
Number of journals covered	Ayurveda – 1 Yoga – 2 Complementary/Alternative/Integrative Medicine – 18 All – 21	902	535, and as and when an article pertaining to AYUSH is published in a journal other than those enlisted, it is considered for inclusion based on merits through editorial vetting
Clinical article grading policy	No grading is provided	No grading is provided	Grading clinical research articles into A, B, C grades based on 'General guidelines for methodologies on research and evaluation of traditional medicine' published by the World Health Organization
Search	Free-flowing; advance search	Free-flowing	Free-flowing and by AYUSH category
Number of AYUSH related articles	Ayurveda – 6267 Yoga – 6297 Naturopathy – 1430 Unani – 703 Siddha – 463 Homoeopathy – 6129 Sowa-Rigpa – 22 Total – 21,311	Ayurveda – 15,172 (1. Dhara articles with keyword Ayurveda in Dhara 9025 2. PubMed articles in DHARA with keyword Ayurveda 6147)	Ayurveda – 23,240 Yoga and Naturopathy – 1425 Unani – 2667 Siddha – 2182 Homeopathy – 2469 Sowa-Rigpa – Nil Total – 31,983

Table 1 also illustrates that for AYUSH systems, ARP hosts by far the largest number of articles, which is likely to increase in due course.

Success of ARP

The success of ARP has served as a proof of the concept of inter-system dialogue within the medical fraternity. Further, it sets an example of building a working relationship within the existing standard frameworks, viz. ICD and ICPC, which in a way has laid the foundation for the idea of dual coding. This is a standard practice of assigning traditional medicine diagnostic code along with the relevant ICD-10/11 code based on specific epistemologies. It is widely practised as a policy of medical case recording by the Chinese⁹ and Korean governments since several decades. The innovation in ARP facilitated later developments such as launch of the National AYUSH Morbidity and Standardized Terminologies Electronic (NAMASTE) portal (2017)¹¹, AYUSH Hospital Information Management System (AHMIS) (2018)¹⁵ and collaborative projects with WHO for drafting ICD-11 codes. The portal is regularly visited by research scholars and other stakeholders of AYUSH, biomedicine, pharmacology, interdisciplinary teams working on the history of science, medicine, sociology, anthropology, public health, etc. Often searches are for identifying safe, effective AYUSH drugs/treatment procedures based on graded clinical trails, pharmacological leads from pre-clinical section, manufacturing leads from drug (standardization) section, and for novel ideas and to review works from the fundamental

section. The ARP is the only source of scanned copies of articles for journals like *Aryavaidyan* which have no electronic presence. Further, it serves as a common dashboard to provide links for fetching copies of extra mural research-based outcomes funded by the Ministry of AYUSH, and any other developments which need to be placed in the public domain. A recent example is the availability of a dedicated 'National Repository on AYUSH COVID-19 Clinical and other R&D Initiatives', which gives insight into research works in AYUSH on COVID-19. This is a phenomenal trajectory of events under the Ministry of AYUSH (then Department), which are worthy of due recognition and appreciation.

The way forward

ARP is yet to incorporate some standard references, viz. from classical textbooks. Besides, the portal can include standard references, like standard treatment guidelines, local health traditions, drug monographs, plant monographs, and formulary of India and other formularies. These were part of the original plan for ensuring completeness of this portal and help it serve as a single window for authentic information on research, policy and reference materials for AYUSH systems.

ARP has had highest contributions from Ayurveda, followed by the Siddha system. Other AYUSH systems need to gear up to include more articles and upload their contents. On the technological front, launch of a mobile app is a logical extension to cater to the young generation. ARP and DHARA could be integrated at the back end to

form a single, large database on AYUSH literature. Further, doctoral and postgraduate dissertations uploaded on Shodhganga—a reservoir of Indian thesis (<https://shodhganga.inflibnet.ac.in/>) can be considered for inclusion in ARP. It is recommended to conduct periodical sensitization programmes on how to use ARP for AYUSH faculty, research scholars and other interdisciplinary teams to ensure its optimum utilization. This must be backed up with proper feedback mechanisms for further improvements and availability of metrics in the public domain to substantiate real-time utilization of the portal.

Finally, the momentum has to be sustained and ARP should aim to become a world-renowned standard repository like the PubMed. It could aspire to add traditional and complementary system-related information globally, which is presently not indexed or captured by PubMed.

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