INTERDISCIPLINARY JOURNAL OF YAGYA RESEARCH • 2021 • VOL 4 • ISSUE 2 • 28-39

Perspective Article

Advancement of Research on Yagya : National Symposium Consensus

Rajani Joshi[1], Amritanshu Shriwastav[2], Varun Manek[3], Pankaj Tiwari[4], Ambesh Dixit[5], Sumitkumar Mishra[6], Deepti Chugh[7], Anil Jha[8], Raghvendra Gupta[9], Rajesh Ranjan[10], Vivek Vijay[11], Ruchi Singh[12], Ekta Chandel[13], Viral Patel[14], Chinmay Pandya*[15]

[1]Professor, Department of Mathematics, Indian Institute of Technology Bombay; [2]Assistant Professor, Department of Environmental Sciences and Engineering, Indian Institute of Technology Bombay; [3]Maxillofacial Radiologist, CBCT Imaging Centre, Malad, Mumbai; [4]Associate Professor, Department of Chemical Engineering, Indian Institute of Technology Guwahati; [5]Associate Professor, Department of Physics, Indian Institute of Technology Rajasthan, Jodhpur; [6]Scientist, Radio & Atmospheric Sciences, National Physical Laboratory-Council of Scientific & Industrial Research, New Delhi; [7]Post-Doctoral Fellow, Department of Biological sciences and Bioengineering, Indian Institute of Technology Kanpur; [8]CardioThorasicsuper-specialistsurgeon, Mahagujarat Hospital, Nadiad; [9]Associate Professor, Department of Chemical Engineering, Indian Institute of Technology Guwahati; [10]Assistant Professor, Department of Aerospace Engineering, Indian Institute of Technology Kanpur; [11]Assistant Professor, Department of Mathematics, Indian Institute of Technology Rajasthan, Jodhpur; [12]Head, Quality Control, Shantikunj Pharmacy, Dev Sanskriti Vishwavidyalaya, Haridwar; [13]Visiting Scientist, Yagyavalkya Center for Yagya Research, Dev Sanskriti Vishwavidyalaya, Haridwar; [14]Coordinator, Yagyavalkya Center for Yagya Research, Dev Sanskriti Vishwavidyalaya, Haridwar; [15]Pro Vice Chancellor, Dev Sanskriti Vishwavidyalaya, Haridwar.

*Corresponding Email: provc@dsvv.ac.in
https://doi.org/10.36018/ijyr.v4i2.80

ABSTRACT. The Philosophy and Science of Yagya (*Yajóa*) lies at the core of the great values, vast expanse, and universal importance of the Indian Culture and the Vedic Science of holistic wellbeing. Yagya was an integral part of the spiritual teachings and research experiments in the Gurukuls in ancient India. It was also prominent in the cultural activities and ethno practices (for the maintenance of good health, and purity and protection of the environment) in the Indian Society till the Medieval Age. Despite substantial cultural devolution and loss of original texts of wisdom in the medieval times of destructive foreign invasions, substantial information on Yagya may still be found in the Indian scriptures available today. Though in distorted form, it is also practiced as an important sacrament (as "fire-ritual"/*havan*) in many sections of the Indian society till date. However, the wisdom and science of Yagya is completely missing from the streams of science and education. In concordance with the noble objectives of the Dev Sanskriti Vishwavidalaya (DSVV), the "Yagyavalkya Center for Yagya Research" of this university has initiated thorough interdisciplinary research and scientific experiments on Yagya for past three years. Towards advancement and expansion of this research,

the centre had organized a one-day national symposium for a brainstorming session and interaction among distinguished experts and researchers in different fields of medical, biological, chemical, and mathematical sciences, and engineering/technology. The symposium was held in the DSVV campus at Haridwar on December4, 2021. The present consensus paper outlines the background, purpose, and outcome of the symposium with a focus on the promising scope of advanced research on Yagya for holistic Health and a pure Environment.

KEYWORDS. Yagya Research, Physicochemical, Biochemical & Phyto-chemical Analysis, Microbial & Clinical Studies, Data Analysis, Mathematical Modeling, and Simulations.

INTRODUCTION

The Vedas signify Yagya as the nucleus of the cosmic creation and the cycle of Nature (अयं यज्ञो विश्वस्य भुवनस्य नाभिः) [Rigveda: 1|164|36; and similar quotes in Yajurveda 23|62; and Atharvaveda: 9|10|14]. Indeed, the creation, manifestation, and existence of the cosmos, and the origin and sustenance of life become possible only through a continuous process of Yagya in Nature (1).

The Vedic *rishis* (ancient Indian seer-sages) had realized the divine grandeur and eternal importance of Yagya through their spiritual wisdom. They researched and expanded the philosophy and science of Yagya in their Gurukuls (centers/schools of higher learning and illumined development of personality). They disseminated it via Vedic Culture and Science for the holistic wellbeing, righteous development, and sustained progress of the world in absolute harmony with Nature.

In simple terms, the philosophy of Yagya teaches virtuous development of individuals and society, noble deeds, and harmony with Nature and all beings in its vast domains. The science of Yagya pertains to its experimental procedure which demonstrates and inspires its teachings in a practical way.

In a systematic experiment of Yagya, specific amounts of the *havan samagri* (a coarse dry-powder of selected plant medicines/herbs combined in specific proportions), mixed with specific amounts of cow's *ghee* (clarified butter, preferably made from Indian cow's curd), and some dry& nutritious natural products are offered in the *Yagyagni* (Yagya's fire) with collective chanting of some powerful Vedic Mantras at a specific rhythm. *"Yagyagni"* is the fire of selected medicinal wood (called *samidha*) in a specially designed fire-pit (*yagya-kunda* or *havan-kunda*). The *havan samagri* (with *ghee*, etc.) is processed in this fire mainly by slow combustion and sublimation process, which releases (outputs) subtlized/ sublimated/ vaporized phytochemicals, volatilized medicinal products, aromatic essential oils, negative ions, and medicinal fumes and gases, etc. This experimental practice (i.e., 'fire-ritual' form of Yagya, which, at a small-scale is also called as *havan* or *homa*®) is an effective inhalation therapy for the participants. Its output also spreads in the surroundings and purifies the air, water, and soil up to a certain distance (2-5).

India continued to be a heaven-like divine land in the post-Vedic times too, as long as the teachings and practices of Yagya were sincerely adopted by its people. However, gradual loss of the original texts of Indian wisdom since the Mahabharata war and the devastating attacks (aimed at plundering the prosperity of India and destroying its ancient knowledge and cultural values) of the invaders from

middle east Asia and other countries in medieval times caused tumultuous disturbances in the Indian society and its cultural practices. In the present times, Yagya as a traditional "fire-ritual" is still practiced, though in a distorted form, on some auspicious occasions or as part of some religious customs/sacraments in many sections of the Indian Society. Some scriptures (preserved by some dedicated scholars of the Vedic Culture) available today also provide substantial knowledge on Yagya. However, to the best of our knowledge, there is no scrupulous effort taken by any centre/institute of higher knowledge and education, to study, teach and research on Yagya.

REDISCOVERING THE ANCIENT SCIENCE OF YAGYA

The Dev Sanskriti Vishwavidalaya (DSVV), a UGC-approved and NAAC accredited University at Haridwar, is founded with a noble objective as per the vision of its patron founder Vedmurti Taponishtha Pandit Shriram Sharma Acharya, a seer-sage, preeminent spiritual scientist, distinguished writer, saintly social-reformer, and founder of the All World Gayatri Pariwar. DSVV aims to — resurrect the ancient Indian wisdom, cultural values and practices in scientific light and in a feasible way, for global peace with enlightened progress. To accomplish this noble aim, it has successfully initiated creation of a distinguished generation of youths, who will not only be well-educated and progressive, but will also have morally elevated character, dedication for high ideals of humanity, and zeal and ability to work for global welfare and expansion of virtuous cultural values.

Apart from its other distinguished academic and research departments/units and constructive educational and training courses, the university has established a specialized centre to rediscover and expand the Vedic Science of Yagya. This dedicated centre, rightly named as the "The Yagyavalkya Center for Yagya Research", has extended the earlier research work carried out at DSVV and its former research labs at the Brahm-Varchas Research Centre, Shantikunj, Haridwar. With establishment of a new well-equipped laboratory, the centre has also taken up trend-setting initiatives for thorough research-experiments on (bio)chemical analysis of the process of Yagya and its outputs with major focus on the applications of Yagya as a method of herbal inhalation therapy and herbal purifier of the environment.

The Background

Way back in the early 20th century, Acharya Sharma had envisaged the dreaded problems on health and environmental fronts and several other crises and threats the world is now facing. He had not only suggested specific spiritual solutions as preventive, precautionary, and protective measures but also guided and provided practical training for this purpose under the auspices Yug Nirman Mission and Gayatri Pariwar propounded by him. In particular, his spiritual acumen had recognized the revival of the Vedic knowledge and practice of Yagya as an effective solution to meet the growing challenges on the health and environmental fronts. He had emphasized the need for systemic investigation of the ancient science of Yagya through modern scientific methodologies (6) for this purpose. Motivated by his vision and guidance, brilliant scientist and specialist MD Medicine, Dr. Pranav Pandya, laid the important milestone of starting scientific research on Yagyopathy (Yagya-therapy) in the "Brahm-Varchas Shodh Sansthan (Brahm-Varchas Research Centre)", Shantikunj, Haridwar, within a year its establishment in 1978-79.

Challenges Of Starting From Scratch

Dr. Pranav Pandya had left his lucrative professional position and devoted his entire life for

the great mission of his noble Gurudev Pandit Shriram Sharma Acharya. As a pioneer, he faced tough challenges of setting up a new research lab in an area in which no (modern) scientific experiment was ever carried out! He, under the adept guidance of his noble Guru, first established a library of available scriptures including authentic Vedic and post-Vedic texts. With scrupulous search (without any internet facility, way back in 1979!), he also identified and procured some rare scientific books in relevant areas published so far that were available in India or abroad. The most significant of his collection was the book by a Professor of Chemistry published in 1937. In this book the author, Dr. Satya Prakash had provided some theoretical formulae of the possible chemical reactions during the combustion process of Yagya (7). However, no experiments were reported to confirm these. Neither there were many details available on the phyto-chemicals and other important constituents of herbs/medicinal plants used in the *havan samagri.*

Dr. Pandya planned initial experiments to identify the effects of Yagya through changes, if any, in the lung- functions, blood biochemistry, and selected (neuro)-physiological parameters, of the participants. Some selected equipment were installed for this purpose, considering the essential requirement and the budget constraints. Yagyopathy lab was designed as per Gurudev Pandit Shriram Sharma Acharya's vision, with necessary facilities for experimental testing.

Purity of the constituents of *havan samagri*, thorough knowledge of their medicinal effects, and exact preparation of the *havan samagri* for specific experiment/scientific investigation, etc., are of utmost importance in Yagya. Considering this, and also as part of Acharya ji's vision of revival of the Vedic medicinal science of Ayurveda, a lab for scientific investigations and validation of Ayurvedic medicines and clinical treatment was also set up at the Brahm-Varchas Shodha Sansthan (BSS); some spiritually enlightened and dedicated experts of Ayurveda had joined BSS within few months. Herbal gardens were planted at BSS and its parent institute Shantikunj, Haridwar.

Yagya is incomplete without proper chanting of specific Vedic Mantras (especially the Gayatri Mantra which is revered as the origin of the Vedas and the divine Vedic Culture). So, studies on the deep science of mantras also began at BSS. In a couple of years, some medical doctors and scientists who were motivated for this work also voluntarily joined the team of researchers at this centre for full-time; some experts also started visiting the centre as associates on part-time basis.

Progressive Success

The scientific research work initiated at BSS by its founder-director Dr. Pranav Pandya and his team continued to progress steadily, in spite of the fact that Dr. Pandya and his team also had to devote significant time in spiritual *sadhanas* and social-service projects of mass-awakening, social-upliftment, thought-revolution, spreading the message of scientific spirituality, the resurrection of the foundational elements of the Rishi-Culture (the ancient Indian Culture/the Vedic Culture), etc. Unlike a professional research centre, publication in selected international journals, or aiming at international recognition, etc., was not on the agenda of BSS. The main focus of this unique research centre has been to lay the foundation for re-investigation, validation and dissemination of the ancient Indian knowledge (especially the sublime spiritual sciences of Gayatri Mantra and Yagya) in modern scientific light to eliminate the misconceptions and distortions prevailing since the medieval times, and to establish a platform for

constructive collaboration between spirituality and modern science.

The Brahm-Varchas Research Centre, with consistent support of its parent institute, Shantikunj, Haridwar succeeded to a great extent in creating mass-awareness and eliminating the wrong impressions in the supposed rational, progressive and 'scientifically' trained minds. By the turn of the millennium, when the man-made threats of environmental pollutions and varieties of health hazards became the cause of serious concern, it was necessary to expand the real applications of Yagya in therapeutics (as a herbal inhalation method of natural medication) and large-scale purification and protection of the environment.

As part of the preventive applications, a drive has been initiated by the Gayatri Pariwar fraternity at Shantikunj, Haridwar, to motivate and train more and more people (including the youths) so that they would do Yagyas in their homes every day/week or as frequently as possible. For systematic therapeutic applications of Yagya and its appropriate use for sustenance of the healthy environment and the ecosystem, multifaceted scientific research has been taken up. This promising effort has gradually accelerated with the establishment of DSVV. So far several collaborative/ interdisciplinary research experiments/ projects have been completed that have led to several authentic research papers (8-28) and more than seven Ph.D. degrees. Extended and new research studies on Yagya have gained a boost with expansion of the university and establishment of its "Yagyavalkya Center for Yagya Research" with a well-equipped laboratory for advanced experiments.

THE ROAD AHEAD — CONSENSUS OUTCOME OF THE SYMPOSIUM

The "Yagyavalkya Center for Yagya Research", had organized a one-day national symposium at DSVV on December 4, 2021. The main objective of the symposium was to thoroughly discuss and plan collaborative research projects/activities to further advance the scientific investigations on multiple aspects of Yagya for health and environment. The symposium was conducted in a hybrid mode (with physical/online participation of the speakers and audience). The invited speakers of this symposium included distinguished experts from four Indian Institutes of Technology(IITs), National Environmental Engineering Research Institute (NEERI), Nagpur, and the National Physical Laboratory(NPL), and some eminent medical doctors.

Based on the presentations and discussions on the ongoing research on Yagya with planned extensions and new studies, the authors of this paper, a group of experts and brilliant young researchers from different disciplines of science, technology, and medicine arrived at a consensus on the collaborative as well as independent projects/studies to advance the interdisciplinary research on Yagya for potential applications in healthcare and environmental purification.

The following Section, formatted along the lines similar to the Delphi model (29) outlines the consensus.

Consensus Statement

Considering the promising potential of the fire-ritual form of Yagya as a herbal inhalation therapy, a natural holistic healthcare method, and an effective environmental purifier, three areas are chosen as the principal focus of the research studies in near future. These are outlined in the Sections (I) to (III) below.

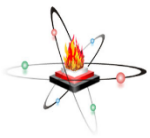
Inputs	Processing	Outputs
Dry Herbal Powder (mixed with *ghee* & small amounts of sugar, nuts, etc.) Medicinal Woods (to light the fire)	 Sublimation, Volatilization, Vaporization, Subtlization Slow-Combustion, etc. Offered with Mantra Chants of Vedic *Mantras*	*Released in Surrounding Air* Sublimated and/or Volatized Phytochemicals, Aromatic Essential Oils, Particulate Matter, Medicinal Fumes, Gases, etc. *Remained in Fire-Pit* Processed Solid Residue, Ash.

Figure 1. Schematic Illustration of a *Yagya*-experiment

I. PHYSICO-CHEMICAL, PHYTO-CHEMICAL & (BIO)CHEMICAL ANALYSIS

As described in the "Introduction" Section, in the 'fire-ritual' experiments of Yagya, *havan samagri* is offered, with chanting of prescribed Vedic Mantra(s) at a specific pace, in the fire of selected medicinal woods lighted in the *yagya-kunda* (havan-*kunda*). The selection of medicinal woods, type and quantities of the ingredients of the *havan samagri*, size, and shape of the *havan*-kunda, and the type, pace, and chanting of the Vedic Mantra(s) depends upon the purpose (e.g., the type of disease which is to be cured) of doing Yagya (3, 5, 30).

During this process, subtlization/ sublimation/ volatilization/ vaporization, and slow combustion of the ingredients (referred as "Input" in Figure 1) take place. Output of this continuous process is released in all directions in the surrounding space. According to theoretical studies it would primarily consist of volatilized phyto-chemicals, aromatic and other essential oils, and medicinal fumes, particulate matter, and gases (7, 30).Several experimental studies on testing of the air, water and soil samples (5, 11, 12), *in-vitro* investigations (14, 30), chemical analysis (5, 30), and systematic psychological and clinical examinations (8, 9, 30) confirm the significant healthy effects of the Yagya-output. Presence of substantial amounts of negative ions in the Yagya-output released in the air is a very distinct healthy effect of Yagya that provides multiple benefits to mental health, positive ambience, and environmental purification (3, 32-34). The *yagya-bhasm* (filtered ash/solid residue) remained in the havan-kunda after Yagya, is also reported to have potential use as a natural pesticide and fertilizer (35).

However, in the scientific community it is often debated that despite several inherent benefits, the output of Yagya may also cause some harms, as, it is most likely to contain respirable particulate matter, chemicals like formaldehyde, and CO, CO2, SO2and some other gases that would pose a risk of polluting the surrounding environment and causing adverse effects on respiratory system of the participants. The solid residue/ash left in the *kunda* after Yagya is also likely to have some oxidized substances and carbon particles.

Considering the elementary chemical reactions of combustion, the presence of these substances is quite likely. The air-sampler readings also show the presence of these elements, but in very small quantities, which, in fact, support some desired medicinal effects — e.g. anti-bacterial reactions and relaxation (5,30) and serve as necessary purifying agents like activated carbon. Another important argument/evidence which counters the suspicion of risks, and favors the benefits of Yagya, is the long-term real-life observation that millions of Hindus/followers of Vedic Culture have been doing/participating in Yagya (fire-ritual) every day or frequently, but no one has ever suffered any health-hazard because of this. On the contrary, most of them who do it regularly are found as protected from seasonal diseases, and infections; moreover, it is a general observation that all the participants feel

energetic and psychologically uplifted after doing Yagya (35).

However, annulling the likely risks, if any, and authentically verifying the benefits for systematic scientific applications, need to be substantiated by thorough investigation and validation. This may be done by adequate physicochemical, phyto-chemical, and (bio)chemical analysis of — the input (raw materials offered in the Yagya-fire), multiple reactions, output (the end products) released in the surroundings, and the outputs remained in the processor (fire-pit) during in the 'fire-ritual' process of Yagya.

Necessity and Possibility of Thorough Investigations & Analysis

Apart from the medicinal constituents of the raw material used in the Yagya, the quantity and effective quality of the output would also depend on other factors such as the shape and size of the *havan-kunda* and arrangement of the *samidhas* in it, as these factors affect the air-flow, pace of combustion, and high temperature variations inside the *havan-kunda* and thus account for partial and complete combustion. Interaction of the output with the particles/chemicals in the surrounding air (including photochemical reactions, and synergistic reactions of output-constituents with each other) may also be an important factor.

The Role of Ghee

In addition to the medicinal herbs and woods, the use of *ghee* (clarified butter) is very essential in the process of Yagya. Beneficial medicinal properties of cow's *ghee* are signified in Ayurveda since ages. Modern laboratories have also shown some of these properties (36). Especially, the *ghee* made from the butter obtained from (the curd of) the milk of a cow of Indian breed is said to have some very healthy chemicals which apart from being rich source of some vitamins, calcium and proteins, also act as natural immuno-modulators. This healthy lipid processed with selected medicinal herbs may contribute to the formation of beneficial particulate matter. This possibility should be considered in the analysis of Yagya-output. Experiments should be conducted for comparative analysis of the effects of *ghee* of a cow of pure Indian breed and its comparison with that of some other cows.

Analysis of Chemical & Physical Properties

Although the (phyto)chemicals present in the extracts of many individual herbs/plant-medicines have been identified and reported in related scientific journals, the changes or new elements present in the combination of multiple herbal constituents should also be investigated by (bio)chemical analysis and mass-spectrometry, high-performance liquid chromatography (HPLC),etc. Properties of the healthy constituents like *ghee*, resins, almonds, sugar, etc., while mixed with the *havan samagri*, may also be analyzed by these techniques. Similar methods may be used to identify the final products in the *yagya-bhasm* and other solid remains in the *kunda* after the Yagya. The analytical techniques such as gas chromatography-mass spectrometry (GC-MS), Nuclear Magnetic Resonance (NMR), etc., would help deduce and analytically characterize the (bio)chemical nature of the substances present in the output collected from the surrounding air during and after controlled experiments of Yagya. The medicinal activity and effects of the selected constituents of the output may then be examined by in-vitro testing. In-vitro testing may also be done by directly passing the Yagya output (released as fumes/vapors/gases) in pathological samples of the bacteria-culture/virus strains using controlled air-flow pump, as was done for example, in the in-vitro tests against Mycobacterium (14).

For expanded studies, protocols for characterization of Yagya-outputs (released in the surrounding), and *yagya-bhasm* after the Yagya may also be designed. Similar protocols may be laid down for analysis of the biomass-variation in the *havan samagri* and Yagya-output during the process of Yagya.

In addition, experimental designs may also be formulated for analysis of particulate matters in the Yagya fumes and also their effects on cloud formation and rainwater.

Ongoing Studies

Priority would be given to continuation of the ongoing investigations including the following:

In-vitro testing of Disease-specific Medicinal Agents

Cell-culture assays and biochemical assays would be continued such as activity of anti-oxidants (37), and anti-cancer agents (18, 38) present in the raw materials as well as the output (released with the vapors/fumes) of Yagya; and, systematic evaluation of specific constituents of Yagya-fumes as potential medicine against pneumonia virus and its multi-drug resistant strains (39), etc.

Air-Sample Data Analysis

Air-sampler studies are important to analyze the continuous variations in the quantities and types of different constituents (including the healthy gases like oxygen, and ozone, or harmful products like, carbon monoxide, formaldehyde, etc.) of Yagya-output released in the surrounding air. Thorough data-analysis of this study would be useful in identifying the role of external factors (e.g. humidity and the direction and speed of air flow in the surroundings). This analysis, together with mathematical modeling (see point III below), and experimental findings, would also help formulation of the multiple chemical reactions taking place inside the *kunda* (fire-pit of Yagya).

Immediate extension of this kind of data-based study, using would be the quantitative and qualitative analysis of the Negative Air Ions (measured using suitable air-ion measuring devices), before, during, and after Yagya in Indoor and Outdoor experiments.

II . CLINICAL STUDIES

Vedic scriptures elaborately describe the use of Yagya for therapeutic benefits as well as for environmental purification (1,3,4,17).The procedure of Yagya indicates that it is a herbal inhalation therapy. To scientifically reinvestigate and validate it's therapeutic potentials in today's time, a three-fold research is required: (i) Analysis at the molecular/(bio)chemical level and *in-vitro* testing; (ii) Clinical studies to examine the possibility, feasibility and modalities of treatment; (iii) Systematic *in-vivo* testing, and "clinical trials" in standard format.

We have addressed the first component of this research earlier [See the Section (I) above]. As part of (ii), several case-studies have been tried out with voluntary participation of the patient(s). In every case, the patients were adult resident Indians. In every Yagya conducted as part of the clinical studies, special *havan samagri* was used as prescribed (for the Yagya therapy of the specific disease/disorder under study) by the concerned experts in the Ayurveda lab/department of the BSS/DSVV (5, 24). The *havan samagri* for each study was carefully prepared in the Pharmacy at DSVV.

Here, it may be noted that all the constituent herbs have been used in the Ayurvedic medicines in dry/powder or decoction form since ages. Yagya has also been practiced by the followers of the

Vedic culture since ages. To the best of our knowledge, no lethal or harmful toxic effect or risky side-effect has been reported in either application. Thus, due care of safety is taken in all the clinical studies carried out so far at BSS/DSVV or in the collaborative labs/hospitals. As outlined below, the findings all the studies are very encouraging in support of Yagya as an effective inhalation therapy.

A systematic clinical study was carried out on nearly twenty patients suffering from pulmonary tuberculosis in the experimental group and a comparable control group of almost the same size (9, 30). The results showed significant efficacy of Yagya in eliminating the symptoms of the disease. The results were also supported by *in-vitro* testing (14).

More recent clinical studies have also shown good potential of Yagya-therapy in the treatment of different kinds of diseases/disorders; for example — health-benefits are verified in patients of epilepsy– two case studies are reported in (20, 21); significant health-care support is offered to cancer-patients during and immediately after chemotherapy-- case studies of three patients (18); Blood Glucose level of diabetic patients is reduced within two weeks-- case studies of 10 patients (26); Thyroid level of patients is brought to normal healthy levels --case studies of 18 patients (19, 24); some patients with stress, anxiety, depression and related psychological problems were benefited (22), etc.

Apart from carrying out these clinical studies on more patients, it would be important to authenticate these by thorough *in-vitro* examinations. Gradually, the successful studies would be extended to *in-vivo* testing and thorough clinical trials in collaboration with suitable medical labs/centres/hospitals.

Environment-Care for Healthcare – Potential of Yagya

Yagya is also found to provide effective support in pre- and post- surgical treatment. As reported in (22), Yagya is performed every morning in the premises of a multi-specialty hospital in Nadiad, Gujarat for past fifteen years. Many critically ill cardiac patients lined up for surgery in this hospital require only minimal essential course of antibiotics. In addition, heart operations like coronary bypass surgery did not require antibiotics higher than the 2nd generation Cephalosporins. Also, in general, the post-surgery infection rate in this hospital at is found close to zero.

This observation further strengthens the earlier findings on antimicrobial activity of Yagya-output released in the air (5, 11, 31) Indeed, healthy environment is a prerequisite to good health. The ever-new microorganisms (including the horrifying pandemic-causing coronavirus), and rising levels of toxic gases, particulate matters and other pollutants, are causing varieties of diseases in the present times and have posed a serious threat even to the sustenance of life on the earth. As mentioned in the earlier sections of this paper, with citation of relevant references (e.g. those in [5]), Yagya is found to offer potential nature-friendly solutions to this problem to a great extent.

Reduced levels of electro-magnetic resonance (EMR) and increase in the presence of negative air-ions in an indoor study [34], signify Yagya as an excellent remedial as well as a preventive method against dreaded diseases like cancer and mental disorders that are supposed to occur due to the excess of EMR in the electronic technology driven lifestyle today.

Ongoing and new research projects outlined under "Air Sample Study" in the Section (I) above will be

of vital importance in investigating these aspects of Yagya towards improvement of environment for better healthcare and its large-scale applications.

III. MATHEMATICAL MODELING

Pharmaco-Kinetic evaluation of bioavailability of the medicinal drugs using compartment models of oral and intra-venous (I.V.) drug-delivery has been extensively used in Pharmacology and Biomedical Sciences to optimize the effective dose regimen and modes of drug delivery. In first of its kind similar modeling and analysis was carried out for inhalation therapy by Yagya (10, 30). The results (for the treatment of pulmonary tuberculosis) showed greater bioavailability of the inhalation of herbal medicines by Yagya as compared to herbal medication by Oral or I.V. modes and as compared to the standard aerosol based inhalation therapy (e.g. for asthma).

Mathematical modeling and data analysis will be a vital component of advancement of Yagya-Research as these would help in interpreting the results of the investigations outlined in Section (I), and also in formulating and validating the possible bio-chemical/ phyto-chemical reactions during and after Yagya.

Study of some Vedic texts indicates that the design (shape) and dimensions of the *yagya-kunda (havan-kunda)* and the *yagya-shala* (the place where a Yagya is performed) are quite important with respect to the objectives (desired effects) of some specific experiments on Yagya. Two recently reported independent studies indicate the scope of mathematical modeling in analyzing these factors. One of these studies was based on implications of the relevant Vedic texts (25), and the other deployed geometrical methods (27). Both show significant results in terms of same volumes of ten different types of *yagya-kundas* (prescribed in the Vedic texts) in spite of their drastically different shapes.

Studies Using Air-Flow Dynamics & Computational Fluid Dynamics

Mathematical modeling and computational simulation of the reactions and air-flow dynamics inside the *yagya-kundas* of different shapes, can address the science behind the optimal dimensions and (geometrical) structures of the *yagya-kundas* described in the Vedic texts. This would also help understand the multi-directional dissipation of energy from the *yagya-kundas* of different shapes.

From the perspective of air-fluid dynamics, Yagya is process of combustion, in which *samidha*, *havan samagri*, and *ghee*, etc. act as a fuel in the presence of oxygen at atmospheric pressure. The reaction is initiated once the fire is lit. At the quasi-steady state when a flame is established, the fuel evaporates and reacts with the oxygen present. The final product of the reaction is a strong function of temperature. The temperature in the *yagya- kund* and flame can have large variations ranging from 200 °C to 1300 °C in different locations (10, 31). Consequently, the product distribution in the *havan-kunda* varies significantly. To be able to predict the reaction, products of the reaction, the temperature distribution in the kund needs to be measured experimentally as well as modeled employing computational fluid dynamics (CFD).

CONCLUSION

Advancement of Research on Yagya would require a multidisciplinary approach to scientifically investigate its effectsand evaluate its potential of wider use for better health and environment. Consensus among the specialist researchers of the relevant disciplines of science, engineering/technology and medicine, who participated in the symposium, has helped draw the

road map for extension of the ongoing research and initiation of new investigations. This is a significant step towards providing a nature-friendly and cost-effective mode of holistic healthcare and environmental purification. Progress in this direction would have an impacting potential for next-generation interdisciplinary research work in the field of Yagya and large-scale expansion of its multiple benefits.

REFERENCES

1. Acharya Sharma Shriram. Yagya Kā Gyāna Vigyāna. Pt. Shriram Sharma Acharya Samagra Vangmaya. Vol. 25. Akhand Jyoti Sansthan, Mathura, UP, India; 1995.

2. Acharya Sharma Shriram Saralaaur Sankśipta Gāyatrī Havan Vidhī. 1st edn., 24th Print.[English Translation by Potdar S(2004). "The Procedure of Yagya" 1st edn. 2004]. YugNirmanYojna, Mathura, UP, India; 2003

3. Acharya Sharma Shriram. Yagya – Eka Smagra Upachāra Prakriyā. Pt. Shriram Sharma Acharya Samagra Vangmaya. Vol. 26; Akhand Jyoti Sansthan, Mathura; UP, India; 1995

4. Agnihotri F. L. Yagya Chikitsā: Kśaya Roga Kī Prākṛatika Achūka Chikitsā. Satyadharm Prakashan, Rohatak; Haryana, India; 2004

5. Pandya P. (Editor) Applied Science of Yagya for Health & Environment. Shri Vedmata Gayatri Trust, Shantikunj, Haridwar, India; 2004. http://literature.awgp.org/book/Applied_Science_of_Yagya_for_Health_and_Environment or www.awgp.org

6. Acharya Sharma Shriram (Edior).Yagya Pita Ke Liye Aba Yah Kiya Jana Cahiye. Akhand Jyoti. December Issue, 74; 1995 http://literature.awgp.org/akhandjyoti/1955/December/v1.74

7. Satya Prakash. Agnihotra- A Study from the Chemical Stand Point; The SarvaDeshik Arya Pratinidhi Sabha, Delhi; 1937

8. Pandya P. (Editor).EkaAnokhaPrayoga, Vilakshana Rahe JisakeNishkarsh. Akhand Jyoti. 2001 November Issue, 30-32.

9. Raghuvanshi M, Pandya P, Joshi RR. Yagyopathic Herbal Treatment of Pulmonary Tuberculosis Symptoms - A Clinical Trial. Alter. &Compl. Therapies. 2004;10(2):101-105. https://doi.org/10.1089/107628004773933352

10. Joshi RR, Raghuvanshi M, Pandya P. Yagyopathy Vs Oral and I.V. Drug Administration: Evaluation for Pulmonary Tuberculosis using Compartment Modeling. J. BiologicalSystems. 2006;14(3):463-489. https://doi.org/10.1142/S0218339006001891

11. Saxena M, Sengupta B, Pandya P. A Study of the Impact of Yagya on Indoor Microbial Environments.Ind. J. Air Pollut.Control. 2007;VII(1):6-15

12. Saxena M, Sengupta B, Pandya P. Comparative Studies of Yagya vs Non-Yagya in Microbial Environments.Ind. J. AirPollut. Control. 2007;VII(1):16-24

13. Saxena M, Sengupta B, Pandya P. The Air-Pollution Index.Ind. J. Air Pollut Control. 2007;VI(2):29-42.

14. Raghuvanshi M, Pandya P, Joshi RR. In-vitro Testing of An Ethnobotanical Inhalation Therapy Against Pulmonary TuberculosisPhytothérapie. 2009;17(5):243-249. https://doi.org/10.1007/s10298-009-0413-8

15. Saxena M, Kumar B, Matharu S. Impact of Yagya on Particulate Matter.Interdisp. J. Yagya Res. 2018;1(1):1-8. https://doi.org/10.36018/ijyr.v1i1.5

16. Singh R, Singh SK. Gayatri Mantra Chanting Helps Generate Higher Antimicrobial Activity of Yagya'sSmoke. Interdisp. J. Yagya Res. 2018;1(1):9-14. https://doi.org/10.36018/ijyr.v1i1.6

17. Verma S, Mishra A, Shrivastava V. Yagya Therapy in Vedic and Ayurvedic Literature: A Preliminary exploration. Interdiscipl. J Yagya Res. 2018;1(1):15-20. https://doi.org/10.36018/ijyr.v1i1.7

18. Mishra A, Batham L, Shrivastava V. Yagya Therapy as supportive care in cancer patients improved quality of life: Case studies. Interdiscipl. J Yagya Res. 2018;1(1):26-33. https://doi.org/10.36018/ijyr.v1i1.3

19. Verma S, Kumar P., Mishra A, Shrivastava V.Yagya Therapy for Sub-Clinical Hypothyroidism: A Case Study. Interdiscipl. J Yagya Res. 2018;1(2):31-36. https://doi.org/10.36018/ijyr.v1i2.13

20. Batham L, Choudhary L, Mishra A, Shrivastava V. Yagya therapy for epileptic seizures: a case study. Interdiscipl. J Yagya Res. 2018;1(2):37-42. https://doi.org/10.36018/ijyr.v1i2.14

21. Mishra A, Batham L, Verma S, Mishra S, Shrivastava V. Management of Epileptic Seizures through an

Integrated Approach including Yagya Therapy. Interdiscipl. J Yagya Res. 2019;2(1):52-64. https://doi.org/10.36018/ijyr.v2i1.24

22. Jha A. Is Yagya or Agnihotra relevant in the today's time? Interdiscipl. J YagyaRes. 2019;2(1):65-67. https://doi.org/10.36018/ijyr.v2i1.34

23. Nilachal N, Trivedi P. A case study of the effect of Yagya on the level of stress and anxiety. Interdiscipl. J Yagya Res. 2019;2(2):07-10. https://doi.org/10.36018/ijyr.v2i2.44

24. Shrivastava V, Batham L, Mishra A. Yagyopathy for Various Diseases - An Overview. Ayurveda evam Samagra Swasthya Shodhamala. 2019;1(1):1-11. https://sites.google.com/dsvv.ac.in/shodhamala-dahh/asssm11/asssm112

25. Motlani J. The Size and Shape of YagyaKund: Mathematical and Spiritual aspects. Interdiscipl. J Yagya Res. 2020;3(1):08-14. https://doi.org/10.36018/ijyr.v3i1.50

26. Saini AS, Pal S, Shrivastav V. Yagya Therapy Treatment Reduced Blood Glucose Level in Diabetic Patients in 2 weeks - a Single Arm Study.Interdiscipl. J Yagya Res. 2020;3(1):30-36. https://doi.org/10.36018/ijyr.v3i1.43

27. Chandel E, Vijay V. YagyaKunds of one-hast (24 angul) with different shapes have equal volume. Interdiscipl. J Yagya Res. 2020;3(2):01-8. https://doi.org/10.36018/ijyr.v3i2.60

28. Saraswat A, Yadav G, Sharma U, Bisen K, Desai T, Bhagat S, Shrivastava V. Yagya Therapy as adjunct care tended to normalized level of thyroid hormones in 18 thyroid patients after 40 days of treatment. Interdiscipl. J Yagya Res. 2021;3(2):19-28. https://doi.org/10.36018/ijyr.v3i2.61

29. Vogel, C., Zwolinsky, S., Griffiths, C. et al. A Delphi study to build consensus on the definition and use of big data in obesity research. Int J Obes. 2019;43:2573-2586. https://doi.org/10.1038/s41366-018-0313-9

30. Raghuvanshi M. Some Investigations into the Chemical and pharmaceutical Aspects of Yagyopathy. 2006; PhD Thesis, Dev Sanskriti Univ., Haridwar, India

31. Nautial CS, Chauhan PS and Nene YL. Medicinal Smoke Reduces Airborne Bacteria. J. Ethnopharmacol. 2007;114(3):446-451. https://doi.org/10.1016/j.jep.2007.08.038

32. Jiang S-Y, Ma A, Ramachandran S. Negative Air Ions and Their Effects on Human Health and Air Quality Improvement. Intl. J. Mol. Sci. 2018;19(10):2996-3007. https://doi.org/10.3390/ijms19102966

33. Harmer C, Charles M, Mc Tavish S, Favaron E. Negative ion treatment increases positive emotional processing in seasonal affective disorder Psychological Medicine. 2011;42(8):1605-1612 https://doi.org/10.1017/S0033291711002820

34. Saxena M, Sharma M, Sain MK, Bohra G, Gupta R. YagyaReducedthe Level of Indoor Electro-Magnetic Radiations (EMR).Interdiscipl. J Yagya Res. 2018;1(2):22-30. https://doi.org/10.36018/ijyr.v1i2.12

35. Pandya P (Editor). Some reports in the Video Magazine "Yug Pravah" and Fortnighlty News Letter " Pragya Abhiyan" Published by Sri Vedmata Gayatri Trust, Shantikunj, Haridwar; 2018-19.

36. Aneja RP, Murthy TN. Beneficial Effect of Ghee. Nature. 1991;350(March):280. https://doi.org/10.1038/350280a0

37. Singh R. Study of Chemical Constituents of Yagya Material and its Fuels. Dissertation, Dev Sanskriti Vishwavidyalaya; 2017.

38. Patel V. Anti-Cancer Activity of herbal fumes of Yagya, Ongoing experiment at Yagyavalkya Center for Yagya Research [Presented in the National Symposium on "Advancement of Research on Yagya", DSVV Haridwar, December 4, 2021].

39. Chandel E. Anti-pneumonic activity of herbal fumes of Yagya. Ongoing experiment at Yagyavalkya Center for Yagya Research, Part of dissertation - Sam Global University [Presented in the National Symposium on "Advancement of Research on Yagya", DSVV Haridwar, December 4, 2021].