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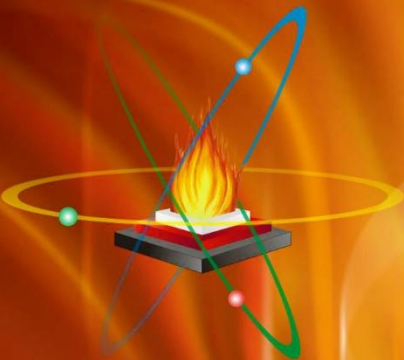
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# Gayatri Mantra Chanting Helps Generate Higher Antimicrobial Activity of Yagya's Smoke

Ruchi Singh<sup>1\*</sup>, Sunil Kumar Singh<sup>2</sup>

<sup>1</sup>Department of Medicinal Plant Sciences, Dev Sanskriti Vishwavidyalaya, Haridwar

<sup>2</sup>Department of Botany, Dayanand Anglo-Vedic College, Kanpur

\*Corresponding author: Ruchi Singh. Email: ruchi.singh@dsvv.ac.in

**Abstract.** Yagya (known as a fire-ritual) is an ancient Vedic Indian method of herbal inhalation therapy. It is also described as an excellent mode of environmental purification. Here, a comparative study of antimicrobial activity of smoke extract of Yagya and non-Yagya has been performed. 'Yagya' in this text, refers to the burning of wood, specific types of dried medicinal plant materials (*hawan samagri*) along with ghee with the citation of mantras, whereas the term Non-Yagya implies burning of wood, *hawan samagri*, along with ghee. In non-Yagya the mantra citation has not been done. An apparatus was designed to simulate the burning process, and the smoke fraction was captured for antimicrobial activity on human

pathogens i.e *Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Bacillus subtilis*, and *Salmonella typh*. Antimicrobial activity was performed using disc diffusion method. Antimicrobial data revealed that the 'smoke-extract' obtained from Yagya experiments with mantra chanting had higher zone of inhibition values compared to that of same experiment conditions except presence of mantra chanting suggesting an important role of the mantra chanting in Yagya for medicinal applications.

**Keywords.** Yagya, smoke, antimicrobial activity, mantra chanting.



## Introduction

The foundation of Vedic culture emanates from the philosophy and science of Yagya. All activities in the limitless expansion of the universe are said to have generated from a grand eternal Yagya. *Ayam Yagya vishwasya bhuvanasya nabhih* (Atharva Veda, 9/15/14) - means, implying Yagya as the fundamental process of manifestation of nature (1).

Yagya symbolizes noble deeds and altruistic mode of life that generates and expands benevolence in all form of nature. In simple terms, it means giving, distributing and thus expanding the good (2). Yagya is a spiritual experiment of sacrificing and sublimating the *hawan samagri* in the *Yagyagni* (Yagya fire) with chanting of Vedic mantras. This ritual when performed at small scale is also known as *hawan*, *homam* or *agnihotra*. Smoke generated through Yagya using medicinal-woods and herbs possess medicinal properties. From time immemorial, human beings have used smoke of medicinal plants to lead a healthy life. Smoke produced at high temperature is a simple way of administering a drug, which exhibits rapid pharmacological activity when inhaled. Plant-derived smokes are used in medicinal as well as ritual contexts worldwide. As a vector for drug administration, plant derived-smokes are used for a wide range of indications in different medicinal systems around the globe (3).

A study reported that the medicinal applications were reported for approximately 740 plant species, from which ritual and religious uses were documented for around 400 species (4). Plant-derived smokes can be inhaled actively or passively as ambient smoke. The volatile combustion products present in smoke are formed processes like hydrolysis, oxidation, dehydration and pyrolysis (5).

Recent researches on assessment of Yagya as well as smoke of medicinal herbs indicated their potential role in reducing air borne bacteria and toxic air pollutants purifying air pollution. Yagya is a scientific process through which the balance of CO<sub>2</sub> and O<sub>2</sub> is maintained in the atmosphere (6,7).

In the Yagya ritual, besides, proper use of wood and herbs, application of Mantra is important. Mantra is usually considered as a part of cultural dimension. However, early concepts in medicine, the cultural and pharmacological aspects of traditional healing therapies such as Yagya is generally regarded as the result of placebo effect (8). However, recent advancements in the field of medicine and science support the therapeutic role of different dimensions of ancient therapies such as Mantras, which were initially considered as a part of the cultural traditions. Therefore, it might be argued that the Yagya, considered as a ritual, should also have effect on human beings. This lays the foundation to study the importance of mantra in Yagya.

As previously mantra's effect, especially Gayatri Mantra's effect, were shown to play role on human mental capacity (9). In addition, positive effect of mantras on the plant species had also been studied (10).

However, to the best of our knowledge, the role of mantra on non-human and non-plant living organisms such as microorganism growth had never been studied. Hence, the study tested the effect on bacterial growth using smoke obtained from Yagya with complete procedure along with mantra chanting, and using the smoke obtained from Yagya without mantra chanting.

## Materials and Methods

### Plant Material

The plant material selected for Yagya was a mixture of odoriferous and medicinal herbs *hawan samagri* (material used in oblation to fire) obtained from Shantikunj Pharmacy, Haridwar, UK, India, that included *Mangifera indica* Linn., *S. album*, *T. cordifolia*, *Cyperus rotundus* Linn., *Hedychium spicatum* Buch-Hem., *Aegle marmelos* Correa, *Cedrus deodara* Roxb., *Nardostachys jatamansi* DC.

### Microorganisms

All strains were procured from Microbial Type Culture Collection (MTCC), IMTECH, Chandigarh, India. Strains used in the study were as following.



*Escherichia coli* (*E. Coli*) (MTCC 1438), *Staphylococcus aureus* (*S. aureus*) (MTCC 1765), *Salmonella typhi* (*S. typhi*) (MTCC 1135) and *Pseudomonas aeruginosa* (*P. aeruginosa*) (MTCC 0735), *Bacillus subtilis* (*B.subtilis*) (MTCC 0441).

#### Experiment procedure

Yagya was performed shortly and adopted from book *Sankshipt Gayatri hawan vidhi* (11). 108 times Gayatri Mantra *ahutis* were given for experiment for both in Yagya and non-Yagya experiments using *hawan samagri* of same lot in the fire. Timings of the *ahutis* were kept same in both the conditions. Smoke was collected and tested for antimicrobial assays.

'Yagya' in this manuscript, referred to the burning of wood, specific types of dried medicinal plant materials (*hawan samagri*) along with ghee with the citation of mantras, whereas the term 'non-Yagya' implied burning of wood, *hawan samagri*, along with ghee. In non-Yagya the mantra citation was not performed.

#### Collection assembly of Yagya smoke

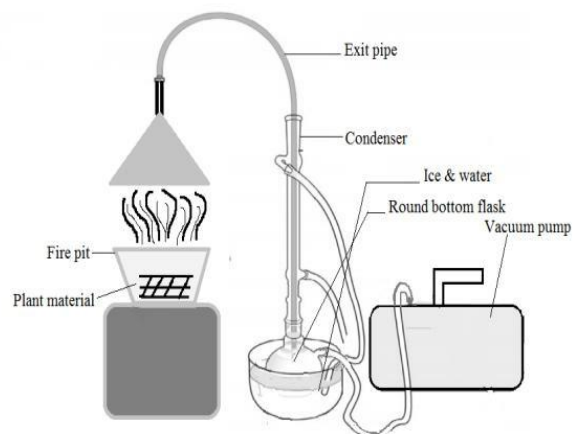
A custom assembly was developed for producing and collecting smoke of all the plant material simulated according to the folk culture (Figure 1). A set up of glass ware assembly was prepared for the collection of smoke produced during the burning of plant material. A double headed round bottom flask filled with methanol was connected to a vacuum pump to create vacuum inside the flask. The flask fitted with a condenser was further connected with a glass funnel hanging over a fire pit to trap the smoke produced during fumigation. The fire pit (dimension 3"\*5"\*2.5") was used to perform Yagya. Smoke liberated during Yagya was collected and the solvent containing the smoke was then subjected to column chromatography in a 2 cm × 45 cm column (made from Borosil glass) fitted with sintered frit and filled with 60–120 mesh Silica Gel-G (Merck, Mumbai) for purification.

#### Statistical analysis

Paired sample student's T Test (TTEST) was performed using online version of Graphpad software, La Jolla, CA (GraphPad QuickCalcs: t test calculator).

#### Antimicrobial assays (disc diffusion method)

This Disc diffusion Assay was used to evaluate the antimicrobial activity of both the extracts. Microorganisms were inoculated on Nutrient Agar (Microxpress - Tulip Diagnostics Ltd, Goa, India) in Petri dishes for purity evaluations prior to use in the bioassay. 1ml of fresh culture (24hrs) from each bacterial strains were centrifuged at 5000 rpm for 5 minutes. Supernatant was removed and cells were resuspended in 1ml of autoclaved Distilled Water (DW). The bacterial suspension thus formed was further diluted with autoclaved DW till the Optical Density of the suspension has reached to 0.1 at 600nm with reference to Distilled Water. Thereafter 0.1 ml of diluted bacterial suspension was spread evenly onto surface of sterile Nutrient Agar media in Petri plates (90mm). After 15 minutes of spreading of bacterial suspension, sterile discs (diameter-5mm; Impregnated



**Figure 1.** Apparatus for smoke production and collection with equal volume - 25 $\mu$ l of each plant extract, at concentration - 100mg/ml were placed at the center of the Petri plates and provided incubation at 37°C in BOD Incubator for time period of 24hrs. The Petri plates were observed after 24hrs of incubation and the data was recorded in terms of visible Zones of Inhibition (in mm) along the diameters of discs. Inhibition zones with diameter less than 12 mm were considered as having low antibacterial activity. Diameters between 12 and 16 mm were considered moderately active, and these with >16mm were considered highly active (Indu, Hatha, Abirosh, Harsha, & Vivekanandan, 2006).

## Results

Antimicrobial activities of the methanol extracts of *Yagya* and non-*Yagya* smoke were evaluated against human pathogens *Escherichia coli*, *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Bacillus subtilis*, *Salmonella typhi* (Figure 2, Table 1). Tetracyclin was employed as a positive standard. It is observed that the antibacterial activity of smoke extracts increased with increasing concentration (Table 1). The extracts showed prominent antibacterial activity against gram negative (*S. typhi*, *E. coli*, *P. aeruginosa*) and gram positive (*S. aureus*, *B. subtilis*) bacteria (Table 1). Among the tested smoke extracts, *Yagya* smoke extract showed highest antibacterial activity of 16 mm inhibition zone against *E. coli*, as shown in (Table 1).

Smoke of *Yagya*, which had mantra chanting in treatment showed statistically significant ( $p < 0.05$ ) antimicrobial activity for all (1.25, 2.5, 5 mg/discs) concentrations compared to smoke of non-*Yagya*, where mantra chanting was absent while other variables were same in both the procedures (Table 1).

## Discussion

The present study showed that *Yagya* smoke had antimicrobial activity. In addition, the study demonstrated that smoke, generated from *Yagya* in which mantra was chanted, had higher microbial growth compared to those of without mantra chanting, and the difference was statistically significant i.e.  $p$  value was  $< 0.05$  (Table 1). This is the first study as of our knowledge, which tested and demonstrated an important role of mantra in *Yagya* using microorganism.

Previously, medicinal importance of herbal smoke of *Yagya* had been illustrated. Some studies on the inhalation of essential oils concluded that the antimicrobial action by gaseous contact was most efficient when the pathogen was exposed at high vapour concentration for a short time (12). A study undertaken by Nautiyal et al. (13) also showed the variation in antimicrobial activity when pathogens were exposed to the medicinal smoke from a mixture of odoriferous and medicinal herbs. We had demonstrated that using medicinal-smoke,

it was possible to reduce the level of pathogenic bacteria present in the air we breathe (Table 1, Figure 2), which was also previously described by others (14,15). The antibacterial activity of the extracts might be due to the presence of various phyto-constituents present in the *Yagya* smoke.

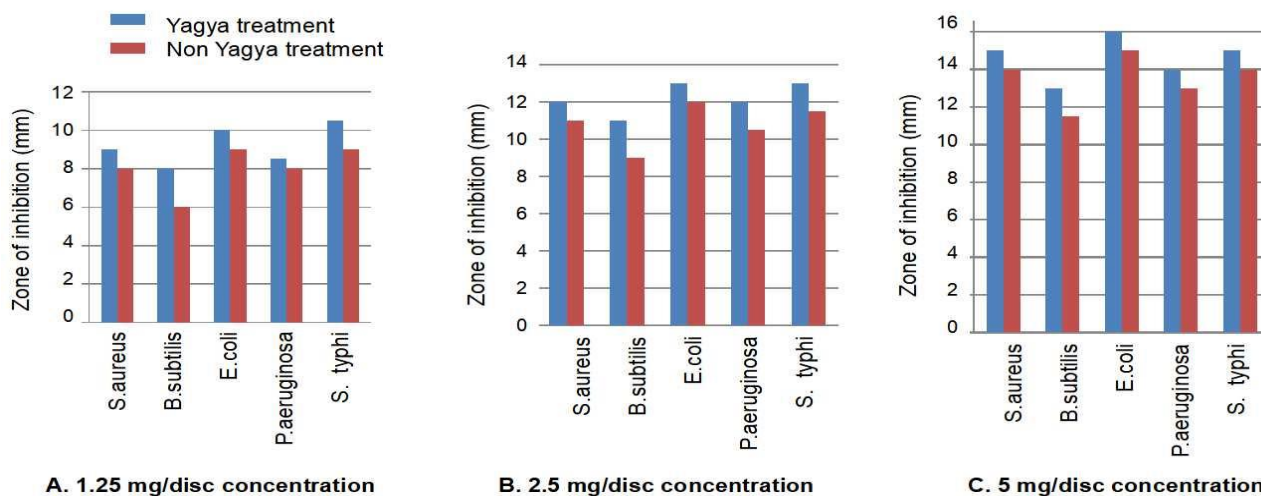
Most of the ingredients of *Hawan Samagri* used in the study were known for their medicinal properties for oral formulations and a number of them were used as medicines by practitioners of the Ayurveda method of treatment using oral or topical applications. However, the ethno-pharmacological aspects of smoke of these herbs with reference to therapeutic applications and health care were not studied much. With this regard, the study contributed an important research in the field that medicinal-smoke emanated from *hawan samagri* showed interesting inhibition effects on the aerial bacterial population. In addition, our study reported one interesting findings that it was not only the fumigation of *hawan samagri*, which contributed the reduction of the air microbes, but, it was the smoke and gases produced as a result of *Yagya* with proper chanting of *mantra* causing an overall decrease in the microbial population of air.

In the study, proper precautions were taken to avoid artifact. Though proper care was taken to keep the interval timings same for *hawan samagri* offerings in the fire, it was also possible that minor time difference between sacrifice of *hawan samagri* with or without *mantra* might had produced difference in combustion process leading to the difference in the anti-microbial activity.

The exact mechanism of how mantra played the role in getting higher antimicrobial activity is to be studied in future experiments. One speculation could be made was that the chanting of *mantras* might had generated electric charge which had changed the properties of phyto-medicines present in *Yagya* smoke contributing anti-microbial properties. Hence, in future, it would be of interest to test the properties of phyto-chemical molecules of *Yagya* smoke and also its methanolic extracts with or without chanting of *mantra* in order to find out the exact mechanisms.

Parameter	Experiment Condition					
	Yagya	Non-Yagya	Yagya	Non-Yagya	Yagya	Non-Yagya
Concentration	1.25	1.25	2.5	2.5	5	5
<i>S.aureus</i>	9	8	12	11	15	14
<i>B.subtilis</i>	8	6	11	9	13	11.5
<i>E.coli</i>	10	9	13	12	16	15
<i>P.aeruginosa</i>	8.5	8	12	10.5	14	13
<i>S. typhi</i>	10.5	9	13	11.5	15	14
p value	0.0093*		0.0017*		0.0004*	
Mean	9.2	8	12.2	10.8	14.6	13.5
SD	1.04	1.23	0.83	1.15	1.14	1.32
N	5	5	5	5	5	5

**Table 1.** Antimicrobial activity of the methanol extracts of different concentration of Yagya and non-Yagya smoke. Yagya and non-Yagya smoke methanol extract was applied to discs containing different bacterial cultures previously treated with 1.25 mg/disc concentration, 2.5 mg/disc concentration, 5 mg/disc concentration of dried smoke-methanol-extract. N indicated number of sample for paired TTEST; SD indicated standard deviation. Symbol \* indicated that p value was <0.05.



**Figure 2.** Graphical representation of antimicrobial activity of the methanol extracts of different concentration of Yagya and non-Yagya smoke. Yagya and non-Yagya smoke methanol extract was applied to discs containing different bacterial cultures previously treated with 1.25 mg/disc concentration, 2.5 mg/disc concentration, 5 mg/disc concentration of dried smoke-methanol-extract.

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