Perspective

How safe is the habitual use of incense sticks?

Ram Deo Pandit[1*] Maya Prakash Prajapati[2]

[1]*Assistant Professor, Department of Dravyaguna Vigyan, Rohilkhand Ayurvedic Medical College and Hospital, Bareilly, Uttar Pradesh, India 243006*

[2]*Assistant Professor, Department of Kriya Sharir, Rohilkhand Ayurvedic Medical College and Hospital, Bareilly, Uttar Pradesh, India 243006*

DOI:

ABSTRACT

Incense burning (agarbatti/dhoop) is deeply rooted in Indian cultural, spiritual, and Ayurvedic traditions, where it symbolizes purification, devotion, and tranquillity. However, increasing scientific evidence suggests that habitual use may pose significant health hazards. This correspondence highlights the overlooked toxicological burden of incense smoke. A clinical case of allergic contact dermatitis with depigmentation, induced by prolonged incense exposure, exemplifies its dermatological risks. Beyond fragrance, burning incense generates a complex mixture of gases and particulate matter, including carbon monoxide, nitrogen oxides, volatile organic compounds, aldehydes, and polycyclic aromatic hydrocarbons—many with known irritant, mutagenic, or carcinogenic potential. Fine particulates ($PM_{2.5}$, PM_{10}) contribute to oxidative stress, airway inflammation, and systemic absorption. Epidemiological studies from Asian and Middle Eastern populations link long-term incense use to asthma, chronic bronchitis, cardiovascular dysfunction, and elevated risks of respiratory and nasopharyngeal cancers. Vulnerable groups such as children, elderly individuals, and pregnant women are particularly at risk due to prolonged indoor exposure. While Ayurveda prescribes dhoopana karma using natural resins, modern incense products often incorporate synthetic binders and perfumes, magnifying hazards. Mitigation strategies include improved ventilation, reduced frequency, safer formulations, and regulatory oversight. Balancing cultural continuity with scientific caution is essential for safeguarding public health.

Keywords: Incense smoke, Indoor air pollution, Allergic contact dermatitis, Respiratory health, AYUSH and tradition

**Corresponding author: dr.ramdeopandit@gmail.com*

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INTRODUCTION

Sir,

A 63-year-old male school teacher presented with pruritic-depigmented macules on the left dorsum of the hand, left shoulder, and abdomen. He reported a 15-year history of incense burning involving various incenses and sandalwood. Forty-eight–hour closed patch testing identified incense fragrance as the allergen. It was inferred that volatilized fragrance particles deposited on the skin, dissolved in sebum, and elicited allergic contact dermatitis with secondary depigmentation [1].

The cultural ritual and its hidden questions

Incense sticks, popularly known as *dhoop* or *agarbatti* in India (especially among the Hindu and Buddhist population), hold a profound place in spiritual observances, meditation, household traditions, and even Ayurvedic practices. In temples, homes, meditation halls, and even in clinical settings, their fragrance is intertwined with purity, devotion, and tranquillity. In Ayurveda and broader AYUSH systems, smoke generated from herbs, resins, and natural substances—*dhoopana karma*—has been prescribed for purification of air, disinfection of dwellings, and promotion of mental calmness. Their fragrance is believed to sanctify spaces, induce calmness, and elevate the ambience during prayer or relaxation. While the cultural and religious significance of incense burning is undeniable, the increasing evidence regarding its potential health consequences compels us to reconsider whether daily and prolonged use is truly safe. Much like the early debates around second hand tobacco smoke, concerns are now being raised about the toxicological burden of incense smoke exposure.

This correspondence synthesizes available scientific evidence, evaluates its resonance with AYUSH perspectives, highlights exposure risks in contemporary usage, and proposes pathways for safe practice. The intention is not to diminish cultural or spiritual value but to stimulate an evidence-based discussion on reconciling tradition with modern toxicological understanding.

Chemical nature of incense smoke: More than just fragrance

Incense sticks are made from powdered plant material (wood, bark, leaves), adhesives (such as jigat powder or guar gum), oxidizers (often saltpetre), fragrance ingredients (natural oils or synthetic aromatics), and a bamboo stick. When lit, the smouldering tip undergoes incomplete combustion, releasing a mixture of gases, vapours, and solid particles suspended in air. When burned, incense sticks release a complex mixture of

gaseous and particulate matter. These emissions include carbon monoxide, carbon dioxide, nitrogen oxides, carbonyl compounds (formaldehyde, acetaldehyde, acrolein—agents linked to airway inflammation and carcinogenesis) volatile organic compounds (VOCs - Benzene, toluene, xylenes, and styrene, which are recognized irritants and in some cases carcinogens), sulfur dioxide, and fine particulate matter ($PM_{2.5}$ and PM_{10}). In addition, polycyclic aromatic hydrocarbons (PAHs- nown for their mutagenic and carcinogenic potential) such as benzopyrene, and aldehydes like formaldehyde and acetaldehyde, have been documented. Studies comparing incense smoke to cigarette smoke reveal startling overlaps in composition, with some toxicants being generated in even greater concentrations during incense combustion [2].

The particulate load is particularly concerning. Incense burning indoors leads to suspended fine particles that can persist in poorly ventilated rooms for hours, ensuring prolonged inhalation by all occupants.

Inhalation pathways: From nose to systemic impact

The respiratory tract is the primary interface for incense-derived pollutants. Inhaled fine and ultrafine particles bypass the nasal filtration system and reach the alveoli, where they provoke oxidative stress, local inflammation, and even systemic circulation of toxicants. Repeated exposure increases risks for chronic rhinitis, bronchitis, asthma exacerbations, and diminished lung function over time. The similarity of incense smoke's impact to household air pollution from biomass fuels is noteworthy, with both creating a pro-inflammatory pulmonary milieu [3].

Health evidence from populations and case studies

A growing number of epidemiological investigations have sought to establish links between incense burning and disease outcomes. Studies in Chinese, Taiwanese, and Middle Eastern populations—where incense use is frequent—have reported higher rates of nasopharyngeal carcinoma, respiratory ailments, and even cardiovascular abnormalities among habitual users [4, 5]. Children and elderly individuals appear more vulnerable due to weaker immune defences and prolonged indoor exposure.

Cross-sectional research in asthmatic cohorts reveals incense smoke as a significant trigger of wheezing, nocturnal breathlessness, and hospital admissions. In some regions, incense burning has also been associated with elevated biomarkers of systemic inflammation, raising concerns about its role in accelerating atherosclerosis.

Carcinogenic potential: A silent hazard

Among the most debated health consequences of incense use is carcinogenesis. The International Agency for Research on Cancer (IARC) has classified emissions from burning organic matter—including incense—as potentially carcinogenic to humans. Laboratory assays demonstrate mutagenic potential of particulate extracts in bacterial and mammalian cell cultures. Longitudinal studies, although limited in number, indicate possible associations between chronic incense exposure and cancers of the lung, upper respiratory tract, and urinary bladder [6].

Although the risk magnitude is lower compared to direct smoking of tobacco, the widespread and prolonged nature of incense exposure makes even small relative risks significant at the population level.

Cardiovascular concerns: Beyond the lungs

Emerging evidence highlights the cardiovascular implications of incense smoke. Fine particulate matter and carbon monoxide may impair endothelial function, alter heart rate variability, and contribute to hypertension. An important study from Singapore observed a correlation between lifetime incense use and elevated cardiovascular mortality. The mechanistic link appears rooted in systemic oxidative stress and chronic low-grade inflammation induced by prolonged inhalation of incense particulates.

Relevance to Ayurveda and traditional practices

Within Ayurveda, aromatic herbs and resins such as *guggulu* (Commiphora wightii), *loban* (styrax resin), and *dhoopana dravyas* have been traditionally burned for *rakshoghna* (disinfection), spiritual, and therapeutic purposes. Classical texts describe fumigation (*dhoopana karma*) for purifying environments and alleviating ailments. However, the scale and frequency of incense burning in ancient times differed from present-day practices, where commercially produced sticks are often composed of synthetic perfumes, chemical binders, and adulterated fillers. Thus, the risk profile of synthetic incense products cannot be equated with traditional *homa* or ritual fumigation.

Public health implications: The indoor pollution challenge

India already battles a significant burden of indoor air pollution due to biomass cooking fuels. Adding incense smoke to this burden, particularly in congested urban homes with limited ventilation, exacerbates respiratory and cardiovascular vulnerabilities.

Vulnerable populations—including pregnant women, infants, and elderly individuals—face disproportionately higher risks.

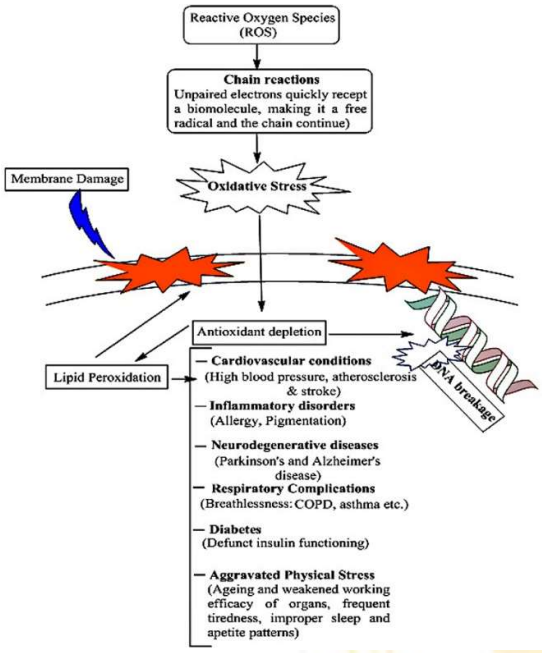

Figure 1 Risks of aggravated oxidative stressy, depicting the possibilities of aggravated free-radical activities [8].

The lack of standardized regulations for incense manufacturing further complicates matters. Variability in chemical composition, fragrance additives, and combustion quality means consumers are often unaware of the true toxic profile of their chosen incense products [7, 9].

Risk mitigation: Practical and policy-level strategies

While cultural and religious sentiments prevent outright avoidance of incense, several pragmatic measures can be considered:

1. **Ventilation Enhancement**: Ensuring cross-ventilation while burning incense markedly reduces pollutant accumulation.
2. **Reduced Frequency**: Limiting daily use and avoiding prolonged burning sessions lowers cumulative exposure.
3. **Alternative Practices**: Substituting incense sticks with non-combustible fragrance diffusers, essential oils, or natural flowers may fulfill the ritualistic requirement without emissions.
4. **Product Regulation**: Establishing safety standards for incense manufacturing, including limits on PAHs and synthetic fragrances, can minimize health hazards.
5. **Awareness Campaigns**: Educating the public about health risks, akin to anti-tobacco messaging, while respecting cultural sensitivities.

Future directions for AYUSH and biomedical research

There is an urgent need for multidisciplinary inquiry that bridges toxicology, epidemiology, and Ayurveda. Key areas of focus include:

- Comparative analysis of traditional herbal *dhoopana* formulations versus modern incense sticks.
- Longitudinal cohort studies in Indian populations quantifying incense exposure and health outcomes.
- Laboratory evaluation of mutagenic and pro-inflammatory properties of various incense formulations.
- Exploration of safer, plant-based incense alternatives that preserve cultural traditions while reducing toxic emissions.

For AYUSH researchers, this represents an opportunity to design scientifically validated incense formulations rooted in classical texts, but adapted to modern safety expectations.

Conclusion: Balancing tradition with evidence-based caution

Incense burning is deeply interwoven with Indian spiritual and cultural identity. Yet, the body of scientific evidence increasingly highlights its potential as a source of indoor air pollution with respiratory, cardiovascular, and carcinogenic implications. The debate is not about abandoning tradition but about adapting its practice with awareness and safety. Regulators, manufacturers, researchers, and the public must collectively engage in creating safer incense practices that honor cultural continuity while safeguarding health. The prolonged use of incense sticks, an overlooked source of health hazard. Why what was once harmless now represent a measurable health hazard [10].

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