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# "HERBO-MINERAL FORMULATIONS OF AYURVEDA IN CANCER: A SCOPING REVIEW OF PRECLINICAL AND CLINICAL EVIDENCE"

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**ABSTRACT**

**Background:** Herbo-mineral formulations (*Rasaushadhi*), including *bhasmas* of gold, mica, zinc, diamond and other materials, are increasingly promoted for cancer, often as nanomedicines. Patients with cancer frequently use them, sometimes instead of conventional treatment. **Objective:** To map the nature and extent of preclinical and clinical evidence on Ayurvedic herbo-mineral formulations in cancer, and to identify gaps and risks. **Methods:** A structured narrative review following scoping principles. Studies were identified through bibliographic databases and reference lists of recent reviews and charted by formulation, study type, cancer model and outcomes. **Results:** The evidence consists mainly of in vitro cytotoxicity studies in cancer cell lines (for example *Abhraka bhasma* in MCF-7 cells with an $IC_{50}$ of about 193 µg/mL, and *Arkeshwara rasa* in MDA-MB-231 cells with an $IC_{50}$ of about 25–32 µg/mL), a smaller number of animal studies, mostly with modified or nano-formulated products, and clinical case reports or small uncontrolled studies. A gold nanoparticle formulation derived from *Swarna bhasma* has been tested in a pilot study in metastatic breast cancer alongside standard care. Many active concentrations in vitro are high relative to plausible tissue levels, selectivity for cancer cells is rarely shown, and characterisation and safety data are often incomplete. No randomised controlled trial of a classical herbo-mineral formulation in cancer was identified. **Conclusion:** The evidence is early-stage and does not support use of herbo-mineral formulations as cancer treatment. A structured pipeline from characterisation to controlled trials, ideally in integrative settings alongside standard care, is required.

**KEYWORDS:** *Rasaushadhi*; *Bhasma*; Cancer; Cytotoxicity; Herbo-mineral formulations; Integrative oncology; Scoping review

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## INTRODUCTION

Cancer is a growing burden in India and worldwide, and many patients use traditional and complementary medicines alongside, or instead of, conventional treatment. In Ayurveda, cancer-like conditions are described under *arbuda*, *granthi* and related terms, and treatment often includes *Rasaushadhi*: *bhasmas* and compound formulations containing metals and minerals such as gold, mica, zinc, copper, mercury and diamond. These formulations are increasingly described as nanomedicines with anticancer potential[1,2].

The question for clinicians, regulators and researchers is what evidence actually supports these claims. A scoping review protocol registered in 2026 noted that no prior scoping or systematic review had mapped the preclinical anticancer evidence for Ayurveda and Siddha herbo-mineral formulations[3]. This review provides an interim map of the preclinical and clinical evidence, highlights its limitations, and proposes a pathway for rigorous evaluation.

## METHODS OF THE REVIEW

This review follows scoping principles: its aim is to map the evidence, not to estimate effects. Studies were identified through PubMed, PubMed Central, DOAJ, Crossref-indexed records and the reference lists of recent reviews on *bhasmas* in cancer, using the terms *bhasma*, *rasa*, herbo-mineral, herbometallic, *Rasaushadhi*, cancer, tumour, cytotoxicity, apoptosis, lymphoma and breast cancer. Studies of classical or modified Ayurvedic herbo-mineral formulations in cancer cell lines, animal models or patients were charted by formulation, study type, cancer model, concentration or dose, and outcome. Studies of purely herbal products, and of laboratory-synthesised nanoparticles without Ayurvedic processing, were excluded unless they provided direct context. Formal screening counts were not recorded; readers wishing to update this work as a systematic scoping review may use the published protocol[3].

## MAP OF THE EVIDENCE

**Table 1. Representative studies of Ayurvedic herbo-mineral formulations in cancer**

| Formulation | Study type and model | Main reported findings |
|---|---|---|
| *Abhraka bhasma* | In vitro: MCF-7 breast cancer cells; RAW 264.7 macrophages | Concentration-dependent cell death; about 49% at 200 µg/mL; $IC_{50}$ 193.2 µg/mL; reduced nitrite in stimulated macrophages |
| *Shataputi Abhraka bhasma* | In vitro: lung, leukaemia and prostate cancer cell lines | Anticancer activity reported in several cell lines |
| *Abhraka bhasma* | Review of preclinical and clinical evidence in breast cancer | Cytotoxicity, immunomodulation and DNA repair effects; cytotoxicity lacks selectivity; only two uncontrolled case reports |
| *Arkeshwara rasa* | Characterisation; in vitro: MDA-MB-231 breast cancer cells | Tetrahedrite (Cu–Sb–S) structure; $IC_{50}$ 25.28 µg/mL (MTT) and 31.7 µg/mL (SRB) |
| Herb-mineral combination | In vitro: colorectal carcinoma cell line | Preliminary cytotoxicity and functional group data |
| *Raudra rasa*, classical and modified with *Hiraka bhasma* | Characterisation and screening of anticancer potential | Anticancer potential screened with FTIR and LC-MS characterisation |
| *Yashada bhasma* nanoparticles | In vitro: human pancreatic cancer cell line | Anticancer activity reported |
| Herbometallic nano-drug | In vitro and in vivo: metastatic breast cancer | Inhibition of metastatic growth by depleting intracellular energy |
| Nanoscale diamond-based formulation | Preclinical: immunomodulation and lymphoma | Immunomodulatory activity and potential in lymphoma |
| Nano *Swarna bhasma* (gold nanoparticle formulation) | In vitro, mouse tumour model, pilot clinical study in metastatic breast cancer | Dose-dependent tumour growth inhibition in mice; clinical benefit reported alongside standard care |
| *Swarna bhasma* | Prospective clinical study in cancer | Clinical outcomes reported |

| | | |
|---|---|---|
| Multiple *Rasaushadhi* with herbal medicines | Case report: Hodgkin's lymphoma treated without conventional therapy | Reduction in nodal size reported |

**1. In vitro studies**

Most of the evidence comes from cell culture. Typical studies characterise a formulation, expose one or more cancer cell lines to a range of concentrations for 24–72 hours, and report viability and sometimes markers of apoptosis. *Abhraka bhasma* reduced MCF-7 viability with an $IC_{50}$ of about 193 µg/mL[4], *Shataputi Abhraka bhasma* showed activity in lung, leukaemia and prostate cancer lines[5], and *Arkeshwara rasa*, a copper–antimony–sulphur formulation, had an $IC_{50}$ of about 25–32 µg/mL in MDA-MB-231 cells[7]. *Yashada bhasma* nanoparticles showed activity in a pancreatic cancer line[10], and a modified *Raudra rasa* containing *Hiraka bhasma* has been screened for anticancer potential[9].

**2. Animal studies**

Animal studies are fewer and often involve modified or nano-formulated products rather than classical *bhasmas*. A herbometallic nano-drug inhibited metastatic breast cancer growth[11], a nanoscale diamond-based formulation showed immunomodulatory activity relevant to lymphoma[12], and a gold nanoparticle formulation derived from *Swarna bhasma* slowed tumour growth in mice in a dose-dependent manner after oral administration[13]. Related mica nanoparticles developed outside the Ayurvedic tradition have also shown activity against breast carcinoma through modulation of the tumour immune microenvironment[16], which provides a mechanistic parallel for mica-based *bhasmas* but cannot be used as evidence for them.

**3. Clinical evidence**

Clinical evidence is limited to small studies and case reports. A prospective clinical study of *Swarna bhasma* in cancer has been reported[14]. In a pilot study in metastatic breast cancer, patients receiving a nano *Swarna bhasma* formulation alongside standard care were reported to benefit[13]. Case reports describe tumour regression in lymphoma treated with Ayurvedic regimens that included several *Rasaushadhi*, in one case without conventional therapy[15]. For *Abhraka bhasma* in breast cancer, a recent review found only two uncontrolled case reports[6].

**CRITICAL APPRAISAL**

**1. Concentration and relevance**

Many in vitro studies report activity at tens to hundreds of micrograms per millilitre. Whether such concentrations can be reached in tumours after oral dosing of a few hundred milligrams of a poorly soluble mineral is doubtful, and pharmacokinetic data that would answer this question are almost absent. Activity at high concentrations in cell culture is a weak signal on its own, because many substances are cytotoxic at such levels.

**2. Selectivity**

Selectivity, the ratio of toxicity to cancer cells versus normal cells, is rarely reported. The review of *Abhraka bhasma* explicitly noted that cytotoxicity lacks selectivity[6]. Without a normal cell comparator, a cytotoxic result cannot be interpreted as anticancer potential.

**3. Classical versus modified products**

Several of the most promising studies used modified products: nano-formulations, products combined with specific herbs, or engineered derivatives[11-13]. These may be valuable as new drugs, but their results do not validate the classical *bhasma*. Reports should state clearly whether the product is classical, modified or newly developed.

**4. Characterisation and reproducibility**

Characterisation is improving, with X-ray diffraction, electron microscopy and mass spectrometry used in recent studies[7,9]. Older studies often did not report the source, batch, composition or impurities of the product. Given the large variation between commercial products of the same *bhasma*[17], results from uncharacterised products are difficult to reproduce.

**5. Clinical evidence and risk**

Case reports and pilot studies can generate hypotheses but cannot establish efficacy, because of selection, publication bias and the variable natural history of some cancers. Their main risk is that they encourage patients to delay or abandon effective treatment. The case of Hodgkin's lymphoma, a highly curable cancer with conventional therapy, treated with Ayurveda alone[15] illustrates this concern. Herbo-mineral products may also add toxicity: market surveys have found lead, mercury and arsenic in Ayurvedic products[18,19], and chronic arsenic poisoning after long-term use is documented[20]. Patients receiving

chemotherapy, which itself causes hepatic, renal and haematological toxicity, may be particularl vulnerable.

## PROPOSED EVALUATION PIPELINE

**Table 2. A staged pipeline for evaluating herbo-mineral formulations in cancer**

| Stage | Key activities | Decision criterion |
|---|---|---|
| 1. Characterisation | Phase, composition, impurities, particle size, dissolution; batch consistency | Product is defined and reproducible |
| 2. In vitro screening | Panel of cancer and matched normal cell lines; clinically relevant concentrations; positive controls | Selective activity at achievable concentrations |
| 3. Mechanism | Apoptosis, cell cycle, target engagement, immune effects | Plausible mechanism linked to activity |
| 4. Pharmacokinetics and safety | Absorption, tissue distribution and repeated-dose toxicity in animals | Adequate exposure with acceptable toxicity |
| 5. In vivo efficacy | Xenograft or syngeneic models, ideally combined with standard therapy | Tumour control or enhancement of standard therapy |
| 6. Clinical trials | Phase I safety and pharmacokinetics; randomised add-on trials with standard care | Clinical benefit without compromising standard treatment |

## RESEARCH GAPS

The main gaps are: selectivity data against normal cells; pharmacokinetic data showing that active concentrations can be reached; in vivo studies of classical rather than modified products; interaction studies with chemotherapy and radiotherapy; and controlled clinical trials. Completion of the registered scoping review[3] will help to define the full preclinical landscape.

## CONCLUSION

The evidence on Ayurvedic herbo-mineral formulations in cancer is at an early stage. It consists mainly of in vitro cytotoxicity studies, often at high concentrations and without selectivity data, a smaller number of animal studies with modified products, and clinical case reports and pilot studies. There is no randomised controlled trial of a classical herbo-mineral formulation in cancer. These formulations should not be used as substitutes for evidence-based cancer treatment. A staged pipeline, from characterisation to integrative randomised trials, offers a way to identify any formulations with genuine value.

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