

SUARNAPRASHANA IN CHILDREN: CLASSICAL FOUNDATIONS, PHARMACOLOGICAL PERSPECTIVES, CLINICAL EVIDENCE AND SAFETY CONSIDERATIONS

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ABSTRACT

Background: *Suvarnaprashana* is a traditional Ayurvedic pediatric practice described in *Kashyapa Samhita* under *Lehana* and newborn care. It involves oral administration of processed gold, traditionally with *Madhu* (honey), *Ghrita* (ghee), and selected herbal ingredients. Classical texts attribute benefits related to *Medha* (intellectual function), *Agni* (digestion), *Bala* (strength), longevity, and general health. **Objective:** To critically review the classical foundations and contemporary evidence regarding the immunomodulatory, nootropic, growth-related, and safety effects of *Suvarnaprashana* in children. **Materials and Methods:** Classical Ayurvedic literature and contemporary biomedical literature were reviewed, focusing on physicochemical characterization, experimental studies, clinical trials, and review literature. Study design, interventions, outcomes, and limitations were considered. **Results:** Studies suggest that appropriately prepared *Swarna Bhasma* may

contain nanostructured gold particles, although composition varies with preparation methods. Experimental studies report potential immunomodulatory and nootropic effects. A randomized clinical trial in healthy infants found *Swarna Prashana* to be well tolerated, but most between-group anthropometric, biochemical, and immunological outcomes were not

statistically significant. Review evidence highlights substantial clinical heterogeneity and the need for better-designed trials. **Conclusion:** *Suvarnaprashana* provides an important link between classical Ayurvedic pediatrics and contemporary research. Current evidence remains insufficient to establish definitive clinical efficacy. Future studies should prioritize standardized formulations, physicochemical characterization, long-term safety assessment, and adequately powered randomized controlled trials.

KEYWORDS: *Suvarnaprashana; Swarna Bhasma; Immunomodulation; Pediatric Ayurveda.*

INTRODUCTION

Preventive pediatrics (Kaumarbhritya) constitutes a fundamental component of Ayurveda, emphasizing the preservation of health, enhancement of host resistance (Vyadikshamatva), and promotion of optimal physical and cognitive development from early childhood.^[1,2] Within this preventive framework, *Suvarnaprashana* is described as a specialized *samskara* involving the administration of processed gold, traditionally intended to support vitality, intellect, immunity, and longevity.^[3] In contemporary pediatrics, recurrent respiratory infections, allergic disorders, and concerns related to neurodevelopment and cognitive performance remain common challenges, thereby generating interest in preventive and supportive interventions that may complement conventional pediatric care.^[4] In this context, examination of the classical rationale for *Suvarnaprashana* alongside emerging pharmacological and clinical evidence provides an opportunity to explore its potential relevance within contemporary preventive pediatrics.^[5,6]

Despite growing clinical and scientific interest, the evidence concerning *Suvarnaprashana* remains heterogeneous and fragmented across classical Ayurvedic literature, pharmaceutical characterization studies, experimental investigations, and relatively small clinical studies. Moreover, *Suvarnaprashana* should not be regarded as a single standardized pharmaceutical intervention. Variations in the method of gold processing, formulation composition, dose, administration frequency, adjuvants, and duration of use may substantially influence its pharmacological properties and clinical outcomes. Such variability represents an important limitation when interpreting available evidence and comparing findings across studies. A further consideration is the distinction between traditionally prepared *Swarna Bhasma* and conventionally synthesized gold nanoparticles. Although both contain gold at the nanoscale in some preparations, their physicochemical characteristics may differ considerably.

Parameters such as particle-size distribution, morphology, crystallinity, elemental composition, surface chemistry, aggregation state, and the presence of trace elements or other formulation-derived constituents may influence biological activity, bioavailability, and safety. Consequently, findings obtained from studies of generic gold nanoparticles should not be directly extrapolated to a specific Swarna Bhasma preparation without appropriate pharmaceutical and physicochemical characterization.^[7]

Therefore, a meaningful evaluation of Suvarnaprashana requires an interdisciplinary synthesis integrating its classical Ayurvedic rationale with contemporary evidence on pharmaceutical characterization, pharmacological mechanisms, pediatric clinical outcomes, and toxicological safety. Such a critical appraisal may help distinguish established findings from preliminary observations, identify limitations in the existing evidence base, and define priorities for standardized formulations and well-designed clinical research.

Classical Perspectives of Suvarnaprashana in Kaumarbhritya

The earliest and most prominent references to Suvarnaprashana are found in the Kashyapa Samhita, authored by Acharya Vriddha Jeevaka, where it is detailed under the context of Lehana (supplementary feeding) and newborn care.^[3] Classical texts prescribe the triturating of Swarna Bhasma on a clean grinding stone with water, honey, and cow's ghee, administered facing the eastern direction.^[1,3]

According to classical dictums, the regular administration yields remarkable outcomes

- 1. Medha Agni Bala Vardhanam:** Enhances intellect (Medha), digestive and metabolic fire (Agni), and physical strength (Bala).^[3]
- 2. Ayushyam:** Promotes longevity and acts as a potent rejuvenative (Rasayana).^[3,8]
- 3. Vyadhibhir Na Cha Drusyate:** Confers robust resistance against recurrent infections and pathogenic insults when administered over specific durations such as one to six months.^[1,4]

Ayurveda strictly mandates the use of purified and processed gold (Swarna Bhasma).^[3] Unprocessed gold is classified as toxic and capable of precipitating severe systemic complications, underscoring the advanced metallurgical and pharmacological proficiency of ancient Ayurvedic alchemists (Rasashastra).^[1,6]

Contemporary Scientific Evaluation and Pharmacological Insights

From a modern pharmaceutical standpoint, the physicochemical characteristics of some Swarna Bhasma preparations have prompted comparison with contemporary nanomedicine because nanoscale gold structures have been demonstrated in characterized samples.^[9] The multi-step Shodhana (purification) and Marana (calination) processes outlined in Rasashastra texts yield gold nanoparticles (Swarna Bhasma) typically measuring within the nanometer range.^[5,6]

Absorption Dynamics: Potential Bioavailability and Cellular Interaction

The biological behavior of Swarna Bhasma is likely to depend on its physicochemical characteristics, including particle size, aggregation, crystallinity, surface properties, and elemental composition. Experimental characterization of selected preparations has demonstrated nanostructured gold particles, providing a possible basis for investigating their interaction with biological systems. In vitro studies have also demonstrated cellular internalization of Swarna Bhasma particles without measurable loss of viability under the experimental conditions studied. However, these findings should not be interpreted as evidence of established or enhanced systemic bioavailability in children. Although preliminary human data demonstrate trace systemic absorption of gold following administration of Swarnabhasma, its gastrointestinal absorption, biodistribution, metabolism, tissue accumulation, and elimination remain insufficiently characterized and require further pharmacokinetic investigation.^[10,11,12]

Cellular Mechanisms: Experimental evaluations demonstrate that gold nanoparticles can modulate cellular tight junctions and interact safely with biological membranes without inducing cytotoxicity.^[6]

Clinical Evidence and Immune-Modulatory Impacts

Recent clinical trials and scoping reviews evaluating apparently healthy children receiving Suvarnaprashana demonstrate significant positive outcomes^[4,8]:

Reduction of Morbidity: Evidence indicates a measurable decline in the frequency and severity of recurrent upper respiratory tract infections and seasonal episodes among children receiving regular doses, often synchronized with auspicious timings like Pushya Nakshatra.^[1,4]

Immunomodulation: Immunomodulation represents one of the most frequently proposed contemporary mechanisms of Suvarnaprashana. Experimental studies have reported effects of

Ayurvedic gold preparations on components of nonspecific immunity, providing a biological basis for further investigation. In a randomized controlled clinical trial involving healthy infants, Swarna Prashana containing Swarna Bhasma, Ghrita, and honey was compared with Ghrita and honey alone over four weeks. The intervention was not associated with significant adverse effects or impairment of normal anthropometric or biochemical parameters. Although an NNT-based analysis suggested a possible immunomodulatory effect with respect to normalization of serum IgG, most direct between-group comparisons of immunological parameters were not statistically significant. Therefore, the findings should be interpreted as preliminary evidence of a potential immunomodulatory effect rather than definitive proof of clinical immune enhancement. Preclinical evidence provides additional support for investigation. Bajaj et al. demonstrated augmentation of nonspecific immune responses in mice following administration of traditional gold preparations. However, animal findings cannot be directly extrapolated to clinical protection against infection in children.^[6,13]

Cognitive Performance: Standardized assessment scales reveal noticeable enhancements in cognitive domains, including memory retention, attention spans, and learning capacity, validating the traditional Medhya claims.^[5,8]

Clinical Evidence

Table No. 1: Showing Clinical Evidence.

Evidence level	Major finding	Interpretation
Classical texts	Medha, Agni, Bala, longevity, disease resistance	Traditional claim
Animal studies	Nootropic/immunological signals	Preclinical evidence
In-vitro studies	Cellular interaction of Swarna Bhasma	Mechanistic evidence
Pediatric RCT	Tolerability; possible IgG-related signal	Preliminary clinical evidence
Scoping review	Heterogeneous evidence	Insufficient for definitive efficacy

Nootropic and Neurocognitive Evidence

The traditional attribution of *Medha Vardhana* to Suvarnaprashana has prompted investigation into its potential effects on learning, memory, and other aspects of neurocognitive function. Experimental evidence provides preliminary support for this possibility. Warad et al. evaluated a Swarnaprashana formulation in animal models and reported improvements in selected learning and memory parameters, accompanied by a

reduction in whole-brain acetylcholinesterase activity at the experimental dose. These findings suggest a possible neuropharmacological basis for the traditional *Medhya* concept and provide a rationale for further investigation.

However, the available evidence remains predominantly preclinical. Findings from animal models cannot be directly extrapolated to improvements in intelligence, attention, memory, academic performance, or overall neurodevelopment in human children. In addition, changes in acetylcholinesterase activity alone cannot establish clinically meaningful cognitive enhancement. Future pediatric studies should therefore employ adequately powered, controlled designs and validated age-appropriate neurodevelopmental and cognitive assessment tools to determine whether the experimentally observed effects translate into clinically relevant benefits.^[5]

Safety Considerations and Standardization

Although Suvarnaprashana has a long history of traditional use, its administration in children requires particular attention to pharmaceutical quality, preparation methods, dose, and product-specific safety characteristics.^[1,8] The safety profile of gold-containing Ayurvedic preparations may be influenced by the quality of raw materials, purification and incineration procedures, particle characteristics, elemental composition, and the presence of potentially toxic contaminants. Improperly prepared or inadequately characterized preparations may therefore pose a risk of exposure to undesirable heavy metals or other elemental impurities.^[6,8]

Standardization and quality control are consequently essential for ensuring reproducibility and minimizing potential risks. Characterization should include appropriate assessment of particle-size distribution, morphology, crystallinity, elemental composition, and the presence of toxic elemental residues, in accordance with applicable pharmacopeial and regulatory requirements.^[5,6] Importantly, analytical characterization should be performed on the final pharmaceutical preparation rather than inferred from the properties of gold nanoparticles produced by unrelated manufacturing methods.

Clinical administration should also be individualized according to the child's age, nutritional and clinical status, concomitant medications, and the characteristics of the specific preparation. Particular caution may be warranted in children with significant renal or hepatic dysfunction or those receiving immunosuppressive therapy, although these situations should

be considered on the basis of clinical assessment and available product-specific evidence rather than as universally established contraindications.^[4,8] Robust pediatric pharmacovigilance, standardized manufacturing practices, batch-wise quality testing, and adequately designed long-term safety studies remain important priorities for establishing the safety profile of Suvarnaprashana.

Research Gaps and Future Directions

Despite promising preliminary findings, several important research gaps remain. First, there is substantial heterogeneity in the composition, pharmaceutical processing, dose, and administration schedule of Suvarnaprashana preparations. Development of standardized pharmaceutical specifications is therefore essential for meaningful comparison between studies.

Second, the pharmacokinetic behavior of Swarna Bhasma in children remains insufficiently characterized. Studies investigating gastrointestinal stability, absorption, biodistribution, tissue accumulation, metabolism, and elimination are required.

Third, most available clinical studies have evaluated relatively short-term outcomes and have involved limited sample sizes. Future randomized controlled trials should employ adequate sample sizes, appropriate comparator groups, standardized formulations, preregistered protocols, and validated outcome measures.

Potential clinical outcomes for future studies include frequency and severity of respiratory infections, antibiotic utilization, growth parameters, nutritional status, validated developmental and cognitive assessments, quality of life, and laboratory measures of immune function.

Long-term pediatric safety surveillance is particularly important because childhood represents a period of rapid physiological development. Studies should therefore include systematic monitoring of hepatic, renal, hematological, immunological, and, where appropriate, elemental exposure parameters.

Finally, interdisciplinary collaboration between Ayurvedic pharmacology, Kaumarabhritya, pediatric medicine, pharmaceutical sciences, nanotechnology, immunology, toxicology, and biostatistics may provide a more rigorous framework for evaluating Suvarnaprashana.

CONCLUSION

Suvarnaprashana represents a distinctive component of Ayurvedic pediatric healthcare in which classical concepts of *Lehana*, *Bala*, *Medha*, *Agni*, and disease resistance are combined with the administration of processed gold and selected vehicles or herbal ingredients. Contemporary research has begun to investigate these traditional claims through pharmaceutical characterization, experimental pharmacology, immunological studies, and pediatric clinical trials.

Available evidence suggests biological activity worthy of further investigation, particularly in the domains of immunomodulation and neurocognitive effects. However, the current clinical evidence remains limited and heterogeneous. The available randomized clinical evidence supports short-term tolerability of a standardized study formulation in healthy infants but does not yet establish definitive clinical superiority for improving immunity, growth, or cognitive function. Similarly, experimental nootropic and immunological findings provide mechanistic hypotheses rather than conclusive evidence of benefit in children.

The scientific evaluation of Suvarnaprashana should therefore move beyond generalized claims of efficacy toward reproducible pharmaceutical standardization, rigorous characterization of Swarna Bhasma, dose-response assessment, pharmacokinetic investigation, systematic safety monitoring, and adequately powered randomized controlled trials. Such an evidence-based approach can preserve the classical significance of Suvarnaprashana while establishing a scientifically credible framework for evaluating its potential role in contemporary preventive pediatrics.

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