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CURRENT SCIENTIFIC EVIDENCE ON SWARNA PRASHANA AS AN IMMUNOMODULATORY THERAPY IN CHILDREN: A LITERATURE REVIEW

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ABSTRACT

Swarna Prashana is a classical Ayurvedic pediatric Rasāyana described in the Kāśyapa Saṃhitā for promoting Vyādhikṣamatva (immunity), Medhā (intellect), Smṛti (memory), Bala (strength), and Āyusya (longevity). With the growing emphasis on preventive healthcare and integrative medicine, increasing scientific attention has been directed toward evaluating its potential as an immunomodulatory intervention in children. This narrative review critically evaluates the classical concepts and contemporary scientific evidence regarding the immunomodulatory effects, clinical efficacy, safety, and research gaps associated with Swarna Prashana in pediatric healthcare. Relevant literature was identified from classical Ayurvedic texts, including the Kāśyapa Saṃhitā, Caraka Saṃhitā, and Suśruta Saṃhitā, together with published studies retrieved from PubMed, Scopus, Web of Science, Google Scholar, and AYUSH databases. Experimental studies, randomized controlled trials, observational studies, systematic reviews, and review articles evaluating Swarna Prashana, Swarna Bhasma, and its principal constituents were critically analyzed. Classical literature describes Swarna Prashana as a pediatric Rasāyana capable of enhancing immunity, cognitive development, growth, and overall health. Experimental studies demonstrate that Swarna Bhasma possesses immunomodulatory, antioxidant, anti-inflammatory, and neuroprotective properties, while Go Ghṛta and Madhu contribute antimicrobial, antioxidant, and bioavailability-enhancing effects. Clinical studies have reported improvements in immune function, reduced frequency of recurrent infections, enhanced appetite, improved sleep quality, better cognitive performance, and overall well-being.

among children receiving Swarna Prashana. However, the available evidence is limited by small sample sizes, heterogeneous formulations, methodological limitations, inadequate standardization, and insufficient long-term follow-up. Current evidence suggests that Swarna Prashana is a promising immunomodulatory intervention in pediatric healthcare. Nevertheless, well-designed randomized controlled trials employing standardized formulations, validated outcome measures, and objective immunological biomarkers are required to establish its efficacy, safety, and role in evidence-based integrative pediatric practice.

Keywords: Swarna Prashana, Rasāyana, Vyādhikṣamatva, Immunomodulation

INTRODUCTION

The immune system plays a vital role in protecting children from infectious diseases, maintaining physiological homeostasis, and supporting normal growth and development. During childhood, both innate and adaptive immunity undergo progressive maturation under the influence of genetic, nutritional, environmental, and microbial factors. Although advances in immunization and pediatric healthcare have substantially reduced childhood morbidity, recurrent respiratory tract infections, allergic disorders, and other immune-related conditions remain prevalent worldwide. These challenges have increased interest in safe, preventive, and complementary immunomodulatory interventions that can support conventional pediatric healthcare (1–3).

Ayurveda emphasizes disease prevention and health promotion through the principles of Swasthya Rakshana, Rasāyana, and enhancement of Vyādhikṣamatva (immunity). Among pediatric Rasāyana therapies, Swarna Prashana is a unique intervention described by Ācārya Kāśyapa in the Kāśyapa Saṃhitā (Leha Adhyāya 5/20–25), where Swarna Bhasma is administered with Go Ghṛta and Madhu. Classical texts attribute numerous benefits to this formulation, including improved Medhā (intellect), Smṛti (memory), Bala (strength), longevity, complexion, and immunity. The Caraka Saṃhitā and Suśruta Saṃhitā also recognize Rasāyana therapy as an important approach for promoting tissue nourishment, immunity, and disease prevention (4–6).

Recent experimental studies suggest that Swarna Bhasma possesses immunomodulatory, antioxidant, anti-inflammatory, and neuroprotective properties through macrophage activation, cytokine regulation, and reduction of oxidative stress. Honey and Go Ghṛta further contribute antimicrobial, antioxidant, and bioavailability-enhancing effects (7–11). Clinical studies from India and Sri Lanka have reported reduced recurrent infections, improved appetite, sleep quality, growth, cognitive performance, and general well-being in children receiving Swarna Prashana. However, the available evidence is limited by small sample sizes, methodological heterogeneity, non-standardized formulations, and short follow-up periods (12–15).

Therefore, this narrative review critically evaluates the classical Ayurvedic foundations, pharmacological mechanisms, clinical evidence, safety profile, and research gaps related to Swarna Prashana, providing a scientific basis for future high-quality studies and its potential integration into evidence-based pediatric healthcare.

OBJECTIVES

The objectives of this review are to:

1. To review the classical concepts of *Swarna Prashana* described in Ayurvedic literature.
2. To summarize the available scientific evidence on the immunomodulatory effects of *Swarna Prashana* and its constituents.
3. To evaluate the clinical evidence on the efficacy and safety of *Swarna Prashana* in children.
4. To identify the current research gaps and provide recommendations for future studies.

METHODOLOGY

A narrative literature review was conducted using classical Ayurvedic texts (Kāśyapa Saṃhitā, Charaka Saṃhitā, and Suśruta Saṃhitā) and electronic databases, including PubMed, Scopus, Web of Science, Google Scholar, and the AYUSH Research Portal. Relevant experimental, clinical, and review studies on the immunomodulatory effects, efficacy, and safety of *Swarna Prashana* in children were critically synthesized thematically.

RESULTS AND DISCUSSION

Classical Perspective of Swarna Prashana

Swarna Prashana (Suvarna Prāśana) is one of the most important pediatric Rasāyana interventions described in Ayurveda. The practice is primarily documented in the Kāśyapa Saṃhitā (Leha Adhyāya 5/20–25), where administration of *Swarna Bhasma* mixed with *Madhu* (honey) and *Go Ghṛta* (cow's ghee) is recommended to promote intelligence (*Medhā*), memory (*Smṛti*), physical strength (*Bala*), longevity (*Āyusya*), complexion (*Varṇa*), digestive power (*Agni*), and disease resistance (*Vyādhikṣamatva*) in children (29). Unlike conventional therapeutic formulations, *Swarna Prashana* is primarily intended as a preventive and promotive healthcare intervention that supports optimal growth and development.

The philosophy of *Kaumārbhṛtya*, one of the eight branches of Ayurveda, emphasizes protecting child health from conception through adolescence. Classical texts describe childhood as a period during which body tissues (*Dhātu*), digestive capacity (*Agni*), and immunity (*Ojas*) are still developing, making children more susceptible to infectious diseases and nutritional disorders (29–31). Consequently, Ayurvedic scholars recommended early administration of Rasāyana therapies to strengthen physiological functions before disease develops.

Table 1: Classical descriptions of Swarna Prashana in Ayurvedic literature

Ayurvedic Text	Classical Reference	Description	Reported Benefits
<i>Kāśyapa Saṃhitā</i>	<i>Leha Adhyāya</i> 5/20–25	Administration of <i>Swarna Bhasma</i> with <i>Madhu</i> and <i>Go Ghṛta</i>	<i>Medhā</i> , <i>Smṛti</i> , <i>Bala</i> , <i>Āyusya</i> , <i>Varṇa</i> , <i>Vyādhikṣamatva</i>
<i>Charaka Saṃhitā</i>	Sūtrasthāna 11	Describes <i>Rasāyana</i> and <i>Vyādhikṣamatva</i>	Disease prevention, longevity, enhancement of <i>Ojas</i>
<i>Suśruta Saṃhitā</i>	Sūtrasthāna 15	Explains preventive role of <i>Rasāyana</i>	Health promotion and improved vitality

Among the classical benefits, *Vyādhikṣamatva* has attracted considerable scientific interest because it closely resembles the modern concept of immunity. Acharya Charaka defined

Vyādhikṣamatva as the body's inherent capacity to prevent disease occurrence and reduce disease severity after onset (30). This concept encompasses both disease prevention and recovery, reflecting the coordinated activity of innate and adaptive immune responses recognized in modern immunology.

Similarly, Rasāyana therapy is intended not only to prolong life but also to improve tissue nourishment, maintain metabolic balance, delay ageing, strengthen immunity, and enhance mental functions (30,31). The concept of Ojas, regarded as the essence of all body tissues, is central to this philosophy. Although Ojas has no direct biomedical equivalent, it has been interpreted as representing overall physiological resilience and immune homeostasis.

Table 2: Correlation between Ayurvedic concepts and modern biomedical science

Ayurvedic Concept	Classical Meaning	Modern Biomedical Interpretation
<i>Vyādhikṣamatva</i>	Disease resistance	Innate and adaptive immunity
<i>Ojas</i>	Vital essence	Physiological resilience and immune homeostasis
<i>Rasāyana</i>	Rejuvenation	Immunomodulation and healthy ageing
<i>Medhā</i>	Intelligence	Cognitive development
<i>Smṛti</i>	Memory	Learning and memory functions
<i>Bala</i>	Physical strength	Physical fitness and immune competence
<i>Āyusya</i>	Longevity	Healthy lifespan

The pharmacological rationale of Swarna Prashana is based on the synergistic effects of its ingredients. Swarna Bhasma is considered a potent Rasāyana possessing Balya and Medhya properties. Go Ghṛta serves as a Yogavāhī, enhancing the absorption and delivery of active constituents, while Madhu acts as an Anupāna, improving palatability and stability of the preparation. In several contemporary formulations, Medhya Rasāyana herbs such as Brahmi (*Bacopa monnieri*), Vacā (*Acorus calamus*), and Śaṅkhaṇḍī (*Convolvulus pluricaulis*) are incorporated to enhance cognitive development (34–36).

Table 3: Major ingredients of Swarna Prashana and their therapeutic importance

Ingredient	Ayurvedic Properties	Reported Pharmacological Activities
<i>Swarna Bhasma</i>	<i>Rasāyana, Balya, Medhya</i>	Immunomodulatory, antioxidant, neuroprotective
<i>Madhu</i> (Honey)	<i>Yogavāhī, Anupāna</i>	Antioxidant, antimicrobial, anti-inflammatory
<i>Go Ghṛta</i>	<i>Yogavāhī, Brimhana</i>	Enhances bioavailability, antioxidant, neuroprotective
<i>Brahmi</i>	<i>Medhya Rasāyana</i>	Memory enhancement, antioxidant
<i>Vacā</i>	<i>Medhya</i>	Neuroprotective and cognitive support
<i>Śaṅkhaṇḍī</i>	<i>Medhya Rasāyana</i>	Learning and memory enhancement

Recent pharmacological investigations have demonstrated that Swarna Bhasma may stimulate macrophage activity, enhance phagocytosis, regulate cytokine production, and improve humoral and cellular immune responses (37–39). Characterization studies have further shown that

properly prepared Swarna Bhasma contains nano-sized gold particles, providing a possible explanation for its biological activity.

Honey contributes flavonoids, phenolic compounds, vitamins, enzymes, and antimicrobial peptides with recognized antioxidant and immunomodulatory properties (40). Cow's ghee contains essential fatty acids and phospholipids that enhance the intestinal absorption of lipid-soluble compounds while exerting antioxidant and neuroprotective effects (41). The combination of these ingredients may therefore produce synergistic immunomodulatory and neuroprotective actions.

Table 4: Proposed mechanisms underlying the therapeutic effects of Swarna Prashana

Component	Proposed Mechanism	Expected Clinical Outcome
<i>Swarna Bhasma</i>	Activation of macrophages and cytokine modulation	Enhanced innate and adaptive immunity
Honey	Antioxidant and antimicrobial activity	Reduced infection and oxidative stress
Cow's ghee	Improved absorption of active compounds	Increased therapeutic efficacy
<i>Medhya Rasāyana</i> herbs	Neuroprotective and antioxidant actions	Improved cognition and memory
Combined formulation	Synergistic immunomodulation	Better growth, immunity, and overall wellbeing

Although preliminary clinical studies have reported improvements in recurrent respiratory infections, appetite, growth, cognitive performance, and selected immunological biomarkers among children receiving Swarna Prashana (42–45), the evidence remains limited by heterogeneity in formulations, small sample sizes, and methodological variability. Standardized pharmaceutical preparation, validated immunological outcome measures, and multicentre randomized controlled trials are required to establish its efficacy and safety conclusively.

Overall, the classical Ayurvedic description of Swarna Prashana demonstrates remarkable concordance with contemporary concepts of preventive medicine and immunomodulation. The integration of Rasāyana principles with modern immunology provides a strong theoretical framework for future translational research aimed at validating this traditional pediatric intervention through high-quality clinical evidence.

Clinical Evidence

Overview of Clinical Studies

Although Swarna Prashana has been used in Ayurvedic paediatric practice for centuries, clinical research evaluating its efficacy has expanded mainly over the past two decades. Available evidence includes randomized controlled trials, observational studies, pilot studies, and community-based programmes assessing its effects on immunity, recurrent infections, cognition, growth, appetite, sleep, and overall well-being in children. Most studies report encouraging outcomes, although variations in formulations, dosage schedules, treatment duration, and outcome measures limit direct comparison.

Several clinical studies have demonstrated a reduction in recurrent upper respiratory tract infections, along with improvements in appetite, physical activity, school attendance, and general health. Some investigations have also reported increased serum immunoglobulin (IgG and IgA) levels, indicating enhanced humoral immune responses and supporting the Ayurvedic concept of Vyādhikṣamatva. Pilot studies have further suggested improvements in attention, memory, concentration, and learning ability, particularly when Swarna Prashana is combined with Medhya Rasāyana herbs such as Brahmi and Śaṅkhaṇṇī.

Despite these promising findings, the overall quality of evidence remains moderate. Most studies include small sample sizes, short follow-up periods, inadequate blinding, and inconsistent methodological reporting. Variability in the preparation and quality of Swarna Bhasma further affects study comparability. Therefore, well-designed multicentre randomized controlled trials using standardized formulations, validated immunological biomarkers, and longer follow-up are required to establish the efficacy and safety of Swarna Prashana in paediatric healthcare.

Table 5: Summary of representative clinical studies evaluating Swarna Prashana

Author	Study design	Participants	Intervention	Major findings	Limitations
Bhaskaran et al.	Randomized controlled trial	Healthy children	<i>Swarna Prashana</i> for several months	Improved immune status and reduced recurrent infections	Small sample size
Uppinakuduru et al.	Double-blind randomized trial	School-aged children	Monthly <i>Swarnamrithaprashana</i>	Improvement in general health and immunity	Short follow-up
Kumar et al.	Pilot clinical study	Healthy children	Daily <i>Swarna Prashana</i>	Improved appetite, cognition and well-being	No long-term follow-up
Jayasooriya et al.	Observational study	Sri Lankan children	<i>Swarna Prashana</i> programme	Reduced frequency of common childhood illnesses	Non-randomized design
Various community programmes	Observational	Healthy children	Monthly administration	Good acceptability and safety	Lack of control groups

Clinical Outcomes Reported

The clinical benefits reported across studies can be grouped into five principal domains.

Immunological Outcomes

Several investigations demonstrated improvements in immune function, including increased immunoglobulin concentrations, enhanced resistance to respiratory tract infections, and fewer episodes of febrile illness. Experimental evidence suggests that these effects may result from activation of macrophages, modulation of cytokines, and stimulation of both cellular and humoral immunity.

Growth and Nutritional Outcomes

Children receiving Swarna Prashana frequently showed improved appetite, better weight gain, enhanced physical activity, and improved nutritional status. These observations correspond with the classical Ayurvedic concepts of Bala and Brimhana.

Neurocognitive Outcomes

Improvements in attention span, concentration, memory, and learning behaviour have been reported in several pilot studies. The inclusion of Medhya Rasāyana herbs may contribute to these neuroprotective and cognitive effects.

Quality of Life

Parents commonly reported improvements in sleep quality, activity level, social interaction, and school attendance following regular administration of Swarna Prashana. Although these findings are encouraging, validated quality-of-life instruments were rarely employed.

Safety

Most published clinical studies reported no serious adverse events. Mild gastrointestinal complaints were occasionally described but resolved spontaneously without discontinuation of therapy.

Table 6: Clinical outcomes reported following Swarna Prashana

Outcome	Reported findings	Level of evidence
Recurrent respiratory infections	Reduced frequency	Moderate
Appetite	Improved	Moderate
Weight gain	Mild improvement	Low to moderate
Cognitive performance	Improved attention and memory	Low
General well-being	Improved	Moderate
Sleep quality	Improved	Low
Immunoglobulin levels	Increased IgG and IgA	Moderate
Serious adverse effects	Not reported	Moderate

Critical Appraisal of Current Clinical Evidence

Although the available evidence supports the potential immunomodulatory and health-promoting effects of Swarna Prashana, several important methodological limitations remain.

Most clinical studies enrolled relatively small numbers of participants, reducing statistical power. Treatment duration frequently ranged from one to six months, whereas classical Ayurvedic practice often recommends prolonged administration. Randomization procedures, allocation concealment, and blinding were incompletely reported in several studies, increasing the risk of bias. Outcome measures also varied considerably, with many investigations relying on subjective parental observations rather than validated clinical or immunological biomarkers.

Another important limitation is the lack of pharmaceutical standardization. Differences in the preparation of Swarna Bhasma, particle size, manufacturing procedures, purity testing, and accompanying herbal ingredients may influence both efficacy and safety. Consequently, comparison between studies remains difficult.

Future randomized multicentre trials should employ standardized formulations prepared according to Good Manufacturing Practice (GMP), incorporate validated immunological

biomarkers, include long-term follow-up, and follow CONSORT reporting guidelines. Such studies would provide stronger evidence regarding the clinical efficacy and safety of Swarna Prashana as an evidence-based pediatric immunomodulatory intervention.

Safety, Toxicology and Standardization

Safety of Swarna Prashana

Safety is one of the most important considerations when evaluating any pediatric intervention, particularly those intended for long-term preventive use. Although Swarna Prashana has been administered traditionally to children for centuries with few reported adverse effects, modern scientific evaluation requires systematic assessment of its toxicological profile, pharmaceutical quality, and manufacturing standards. Current evidence suggests that properly prepared Swarna Bhasma manufactured according to classical Ayurvedic procedures and Good Manufacturing Practice (GMP) guidelines is generally safe when administered in recommended therapeutic doses (46–49).

The safety of Swarna Prashana depends largely on the quality of Swarna Bhasma. Classical Ayurvedic pharmaceutics (Rasa Shastra) prescribes elaborate purification (*Śodhana*) and incineration (*Māraṇa*) procedures to convert metallic gold into a therapeutically active and biologically compatible form. These processes reduce particle size, alter physicochemical properties, and remove impurities that may contribute to toxicity. Failure to follow standardized manufacturing procedures may result in contamination with heavy metals or incomplete transformation of raw materials, potentially increasing the risk of adverse effects (46).

Recent advances in nanotechnology have demonstrated that authentic Swarna Bhasma consists predominantly of nano- and micro-sized gold particles with high biocompatibility and low systemic toxicity. Transmission electron microscopy (TEM), scanning electron microscopy (SEM), X-ray diffraction (XRD), Fourier-transform infrared spectroscopy (FTIR), and inductively coupled plasma mass spectrometry (ICP-MS) have been employed to characterize these preparations and verify their quality (47–49). Such analytical techniques are increasingly recognized as essential components of pharmaceutical standardization.

Table 7: Factors influencing the safety of Swarna Prashana

Factor	Influence on Safety	Recommended Practice
Quality of <i>Swarna Bhasma</i>	Major determinant of safety and efficacy	Use authenticated preparations manufactured according to classical methods
<i>Śodhana</i> (purification)	Removes impurities and improves biocompatibility	Strict adherence to classical purification procedures
<i>Māraṇa</i> (incineration)	Produces stable nano-sized particles	Standardized manufacturing process
Dose	Excessive doses may increase adverse effects	Follow age-appropriate therapeutic dosage
Duration of administration	Long-term safety requires monitoring	Periodic clinical assessment
Manufacturing standards	Reduces contamination and batch variability	GMP-certified manufacturers

Toxicological Evidence

Experimental toxicological studies have generally demonstrated a favourable safety profile for properly prepared Swarna Bhasma. Acute and sub-chronic toxicity studies in experimental animals have reported no significant abnormalities in liver function, renal function, haematological parameters, or histopathological examination when therapeutic doses were administered (47,48). Furthermore, gold nanoparticles derived from authentic Swarna Bhasma have shown minimal cytotoxicity in in vitro studies, supporting their potential biomedical applications.

Clinical studies evaluating Swarna Prashana in children have likewise reported a low incidence of adverse events. Mild gastrointestinal symptoms such as transient nausea, abdominal discomfort, or altered bowel habits have occasionally been described but resolved without discontinuation of therapy. Serious adverse reactions, organ toxicity, or allergic manifestations have not been consistently reported in published clinical trials (42–45).

Nevertheless, the available toxicological evidence has several limitations. Most animal studies employed relatively short observation periods, and long-term reproductive toxicity, genotoxicity, carcinogenicity, and pharmacokinetic data remain limited. Comprehensive multicentre safety studies are therefore required before widespread public health implementation can be recommended.

Table 8: Summary of toxicological findings reported for Swarna Bhasma

Study Type	Findings	Overall Conclusion
Acute toxicity	No significant toxicity at therapeutic doses	Safe
Sub-chronic toxicity	Normal liver and kidney function	Safe
Histopathological studies	No major tissue abnormalities	Safe
In vitro cytotoxicity	Minimal cellular toxicity	Good biocompatibility
Clinical studies	Very few adverse effects reported	Well tolerated

Standardization of Swarna Prashana

One of the major challenges limiting wider acceptance of Swarna Prashana is the absence of universal pharmaceutical standardization. Considerable variation exists among commercially available formulations regarding ingredient composition, proportion of Swarna Bhasma, herbal additives, particle size, manufacturing techniques, and dosage recommendations. These differences may contribute substantially to the variability observed in clinical outcomes.

The Ministry of AYUSH and the Ayurvedic Pharmacopoeia of India (API) provide quality standards for Swarna Bhasma, including organoleptic characteristics, physicochemical parameters, analytical specifications, and manufacturing guidelines. Compliance with these standards is essential for ensuring product quality, reproducibility, and patient safety (49,50).

Modern analytical techniques have become indispensable for quality assurance. ICP-MS is widely used to determine elemental composition and detect heavy metal contamination. XRD confirms crystalline structure, SEM and TEM evaluate particle morphology and size distribution,

while FTIR identifies chemical functional groups. Together, these techniques facilitate objective quality assessment and improve batch-to-batch consistency.

Table 9: Recommended quality control parameters for Swarna Prashana

Quality Parameter	Analytical Method	Purpose
Gold content	ICP-MS	Quantification of elemental gold
Heavy metal contamination	ICP-MS/AAS	Safety evaluation
Particle size	SEM/TEM	Nanoparticle characterization
Crystal structure	XRD	Authentication of <i>Swarna Bhasma</i>
Functional groups	FTIR	Chemical characterization
Microbial contamination	Microbiological analysis	Product safety
Stability	Stability testing	Shelf-life determination

Regulatory Considerations

The increasing global use of Ayurvedic medicines has highlighted the importance of harmonized regulatory standards. The World Health Organization (WHO) advocates implementation of Good Agricultural and Collection Practices (GACP), Good Manufacturing Practices (GMP), pharmacovigilance systems, and evidence-based quality assurance for traditional medicines. Adoption of these recommendations would improve international confidence in Swarna Prashana and facilitate its integration into complementary healthcare systems (51).

Pharmacovigilance remains particularly important because children constitute a vulnerable population. National reporting systems should encourage healthcare professionals to document suspected adverse events, thereby strengthening long-term safety surveillance.

CONCLUSION

Swarna Prashana is a classical Ayurvedic pediatric Rasāyana intervention traditionally used to enhance immunity, cognitive development, growth, and overall health in children. Experimental evidence suggests that its components possess immunomodulatory, antioxidant, anti-inflammatory, and neuroprotective properties, supporting the Ayurvedic concepts of Vyādhikṣamatva, Rasāyana, and Ojas. Clinical studies have reported benefits such as reduced recurrent infections, improved appetite, growth, and cognitive performance. However, the current evidence is limited by small sample sizes, methodological heterogeneity, and short follow-up periods. Properly prepared Swarna Bhasma appears to be safe when manufactured according to classical procedures and Good Manufacturing Practice (GMP) standards, although rigorous quality control and pharmacovigilance remain essential. Future multicenter randomized controlled trials using standardized formulations, validated biomarkers, and long-term follow-up are needed to establish efficacy and safety. Overall, Swarna Prashana shows promising potential as an evidence-based complementary intervention in pediatric preventive healthcare, warranting further high-quality interdisciplinary research.

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CONFLICT OF INTEREST

The authors declare that they have no financial or non-financial conflicts of interest related to this work.

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