



## Review Article

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### PHYSIOLOGICAL STUDY ON IMMUNOMODULATORY EFFECTS OF SWARNAPRASHANA: A REVIEW

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#### ABSTRACT

Lehana Karma depicts administration of various herbal drugs, ghee preparations, and Swarna Bhasma along with Ghrita and honey as supplementary feed wherein precise indications are stated in Ayurvedic literature. In Ayurveda, administration of the gold particles in children (0-16 years) is considered to be a unique practice termed as Swarna Prashana (SP). Across the spectrum of human life, from pre-conception to the end of life, gold emerges as a noble metal with significant impacts on well-being and vitality. The remarkable effects of SP on children described in the Samhita are due to the Swarnabindu's ability to quickly absorb and assimilate the gold nanoparticles (GNP) that are present in it. According to various studies on GNP, Swarna Bhasma enhances immunity by stimulating phagocytic activity of peritoneal macrophages. The potential of SP in immunomodulation lies in its application for developing both prophylactic and therapeutic vaccines. In order to operate as a powerful immunomodulator, each component of SP is examined individually as well as in combination in this study.

**Keywords:** Lehana Karma, Swarnaprashana, Gold nanoparticles, Immunity, Immunomodulator.

#### INTRODUCTION

Childhood or infancy is the stage of life when individuals start developing. The future creation of life has a strong basis because of this state of high health. Their physical characteristics, such as anthropometry and physio social development, enable us to track healthy growth. A few of the many factors that affect growth pace are inadequate nutrition, physical hyperactivity, insufficient sleep, physical disease, and emotional illness. Increased dietary requirements, a decrease in appetite, and problems with absorption are brought on by these illnesses. In such cases, the attainment of normal growth and development is postponed during periods of rapid growth and vital development, either temporarily or permanently. The primary goal of Ayurvedic science is preventative and supportive methods is to make young people's lives better. Lehana depicts administration various herbal drugs, ghee preparations, and gold alone as supplementary feeds wherein precise indications are stated. Acharya Kashyap coined the term Swarnaprashana (SP) for administration of gold. Swarna is the main element of the Lehana, as indicated by the term "Swarnaprashana." Swarna administration through the oral route in children for improved health and disease prevention is a long-standing practice. According to Acharya, consistent usage of SP promotes healthy growth, sharpens memory to its highest level, physical development and prevention from diseases. Ghrita infused with Medhya and Rasayana herbs like Brahmi (*Bacopa monnieri*), Mandookaparni (*Centella asiatica*), Yashtimadhu (*Glycyrrhiza glabra*), Shankhpushpi (*Convolvulus pluricaulis*), Vacha (*Acorus calamus*), and Guduchi (*Tinospora cordifolia*) is frequently employed in Swarna Bindu preparation (SBP) which

anticipates greater immunomodulatory and nootropic benefits of SP in kids, i.e., to enhance kid's thinking, learning, and memory.

#### SWARNAPRASHANA

In Ayurveda, the administration of gold particles to children is a distinctive practice known as Swarna Prashana. The term "Swarna" denotes gold, while "Prashana" signifies the act of consumption or ingestion. Hence, SP involves the ingestion of gold in the specified dose and quantity as prescribed<sup>1</sup>. Gold, one of the seven metals delineated in the Sapta Lauha, is designated as Shuddha Lauha, denoting its immaculate purity and outstanding characteristics. Its attributes encompass both preventive and protective properties. Gold's significance spans from pre-conception stages, where it is valued for its Rasayana (rejuvenating) and Vajikarna (aphrodisiac) traits, it finds utility in Pumsavana Karma, ensuring desired gender and fostering proper intrauterine fetal growth. Following birth, gold continues to mild prominence, being incorporated into Lehana (supplementary feeding) and Jatakarma Samskara rituals. As the child matures, gold either alone or in combination with herbal remedies is recommended to enhance various aspects such as Agni (digestive power), Bala (physical strength and immunity), Medha (intellect), Varna (complexion), and Ayu (lifespan). Even during critical phases, such as when signs of impending demise manifest, gold is advocated for its protective influence. Across the spectrum of human life, from pre-conception to the end of life, gold emerges as a noble metal with significant impacts on well-being and vitality<sup>2</sup>.

The particular advantages attributed to SP are outlined as follows:

- Medha Agni Bala Vardhanam (improvement of intellect, digestion, metabolism, immunity, and physical strength)
- Ayushyam (promoting lifespan)
- Mangalam (auspicious)
- Punyam (righteous)
- Vrushyam (aphrodisiac)
- Varnyam (enhancement of colour and complexion)
- Grahapaham (protection from evil spirits and microorganisms).

## DOSAGE

Acharya Kashyap did not specifically indicate the dosage for SP. But, he has provided general dosage of Swarna Bhasma for children<sup>2</sup>. So, the SP dosage can be set using the same procedure. The dosage for Swarna Bhasma are as follows:

- 1/4<sup>th</sup>–1/8<sup>th</sup> **Ratti** (15–30 mg) **Swarna Bhasma**
- 2 **Gunja** (250 mg)
- 1 **Gunja** (125 mg)/As per age
- 1 **Harenu**
- 1/32 **Ratti** (3.9 mg)
- 15.5–62.5 mg of **Swarna Bhasma**.

The administration protocol involves oral intake on an empty stomach, ideally in the early morning. It is suitable for infants and children up to 16 years old. The dosage regimen includes two drops with clarified butter and honey for infants under 6 months old, increasing to four drops thereafter. This regimen can be administered daily for a minimum of 30 days and up to 180 days. Alternatively, it can be administered every 28 days during Pushya Nakshatra, with a minimum requirement of 30 doses<sup>3</sup>.

## INDICATIONS OF SWARNAPRASHANA

According to Kashyap Samhita, SP is recommended for children who have low immunity, recurrent infections, memory issues, delayed growth, general debility, including mental and physical weakness, allergies, appetite loss or poor digestion, dull appearance or dullness in the skin, and delayed puberty.

## CONTRAINDICATIONS OF SWARNAPRASHANA

Due to the risk of organ rejection, SP therapy, should not be administered to children who have had organ transplants. Children with liver and kidney issues should also not receive SP.

## MODE OF ACTION OF SP

### Absorption and assimilation of Swarnabindu

The remarkable effects of SP on children described in the Samhita are due to the Swarnabindu's ability to quickly absorb and assimilate the GNP that are present in it. According to studies on nanoparticles, they can bypass digestion and enter the blood stream directly through the sublingual pathway. GNP were discovered to be absorbed in the small intestine, and blood carried nanoparticles smaller than 58 nm to the target tissues. It has been suggested that SP is preferably to be administered in an empty stomach for optimal absorption or after 2 hours of food consumption.

### SP as Immunomodulator

Gold is one of the noble metals that has been utilized continuously to boost strength and immunity. According to study by S. Bajaj et. all on GNP, Swarna Bhasma enhances immunity by stimulating phagocytic activity of peritoneal cells<sup>4</sup>. Immune cells and the effects of GNP Agglomerates are formed when GNP that range in size from 3 nm to 80 nm come together. It has been

discovered that different sizes of GNP have different impacts on immune cells in terms of absorption and functional responses. More crucially, compared to bare particles, the effects of GNPs functionalized with peptides or oligonucleotides are significantly larger. They can be surface-modified with substances bearing functional groups, including as cyano (-CN), thiol (-SH), carboxy (COOH), and amino (-NH<sub>2</sub>) groups, known for their strong affinity for gold. This increases their stability and biocompatibility. These functional group additives can act as gold capping agents<sup>5</sup>. All immune system parts have been discovered to be significantly impacted by GNP.

Honey and its components acts as a GNP capping agents. A complex mixture of oligosaccharides, amino acids, polypeptides, and proteins makes up honey<sup>6</sup>. All of these compounds or some of them have the ability to spontaneously bind to GNPs, capping the latter and enhancing their immunogenicity. Proline, a substantial component of the protein antigen in many viruses, is the amino acid found in honey in significant amounts<sup>7</sup>. These proline-containing structures can be recognized by polyreactive natural antibodies because proline is typically present at solvent-exposed locations in proteins, such as loops, turns, and the N-terminal first turn of helix<sup>8,9</sup>. Hematopoietic stem cells, dendritic cells, NK cells, and T cell receptors can all develop "trained immunity" after repeated exposure to the wide variety of GNP-conjugated antigenic compounds, such as proline, in honey<sup>10</sup>. Additionally, raw honey contains glycoprotein peptides, which is important since glycosylation increases the peptides' immunogenicity and stability<sup>11</sup>. Each and every immunoglobulin, complement, and MHC type I and II component that participates in antigen presentation is glycosylated. Numerous investigations have revealed that glycosylation significantly affects the absorption of protein antigens and the processing of proteolytic products.<sup>12</sup> As a result, honey's glycosylated peptides have the ability to both stimulate the innate immune system and the adaptive immune system. The trained immunity mechanism of the innate immune system, which is antigen non-specific, can be activated to cause responses against a wide range of novel and unfamiliar antigens.<sup>13</sup>

Ghrita is merely clarified unsalted butter that is made by cooking butter until it turns transparent. Ghee comprises around 95.5% fat, but it also contains a variety of other substances, such as fat-soluble vitamins, minerals, and amino acids.<sup>14</sup> Phospholipids such as glycerophospholipids and sphingolipids, (glyco)proteins, glycolipids (such as cerebrosides and gangliosides), total and partial glycerides, free fatty acids, and cholesterol are all found in the milk fat globule membrane.<sup>15</sup> When employed in emulsions, the phospholipids in ghee serve as emulsifying agents and can produce particles that resemble liposomes. Since immune cells are found in the lymphatics, the lipid coating of bio-decorated GNP aids in lymphatic uptake of the particles, directly exposing the immune cells to the Particulate Antigens.

SP is associated with smaller gold particles that exhibit diverse characteristics such as varying shapes, sizes, charges, and bio-molecular compositions. These particles are characterized by high stability, low toxicity, and minimal immunogenicity due to molecular components present in ghee and honey. These components include sugars, amino acids, proteins, lipids, vitamins, and other constituents. They play a crucial role in coating the gold particles in SP, facilitating multivalent interactions with membrane receptors on antigen-presenting cells (APCs) like dendritic cells. Targeting dendritic cells is a key strategy in enhancing immunotherapies and vaccine development.

The mechanism by which SP interacts with dendritic cells involves several processes. Dendritic cells employ receptor-mediated endocytosis, pinocytosis, and phagocytosis to internalize SP particles. Upon uptake, immature dendritic cells transport these particles into the cytosol. This internalization triggers differentiation into mature dendritic cells, marked by the expression of CD83 and CD86 and morphological changes. The internalized particles, or antigens, are processed in the cytoplasm and presented via the MHC complex to initiate a T cell response.

SP particles, characterized by their mosaic features in size, shape, charge, and composition, facilitate intercellular trafficking within dendritic cells. Consequently, dendritic cells effectively present multiple antigens to T cells. Activation of both dendritic cells and T cells requires soluble cytokines such as IL-7, IL-6, IL-10, IL-12, IL-23, TNF, and IFN to induce an immunogenic response. The potential of SP in immunomodulation lies in its application for developing both prophylactic and therapeutic vaccines.

## CONCLUSION

In conclusion, SP epitomizes Ayurveda's holistic approach to fortifying immunity and nurturing children's well-being. By synergizing Swarna Bhasma with potent herbs, Ghrita, and honey, it promises profound immunomodulatory effects. The synergy between GNP and bio-molecular components augments immunogenicity, priming dendritic cells for robust immune responses. This cascade of events, culminating in T cell activation and cytokine secretion, not only enhances physical health but also bolsters cognitive function and prevents diseases. As research unveils its mechanisms, SP emerges as a beacon of hope in immunotherapy and vaccine development, safeguarding the health and resilience of future generations.

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