EXPLORING THE THERAPEUTIC POTENTIAL OF SWARNA BHASMA AS GOLD NANOMEDICNE AND ITS APPLICATION

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Abstract

Purpose: Swarna Bhasma, a key component in Ayurvedic medicines has recently gained attention as a promising Gold nanomedicine for various therapeutic applications. The herbo-mineral preparation, Gold Bhasma, represents a superior form of administration in Ayurvedic treatments.

Objectives: This review aims to highlight research on the therapeutic applications of Swarna Bhasma with a focus on its role as an Anti-Tumor agent. Beyond its well- documented Anti-Tumor properties, Swarna Bhasma holds potential for treating a wide range of conditions, including lifestyle disorders. Looking ahead, it could be developed as a broad-spectrum therapeutic agent.

Methodology: The review was conducted by searching scholarly articles, reputable websites, academic books, and classical texts, ensuring a comprehensive and well-rounded understanding of the topic.

Findings: Swarna Bhasma possesses strong Anti-Inflammatory and Immunomodulatory properties. It modulates immune cells, including T cells and macrophages, helping prevent Autoimmune disorder. Its nanoparticle nature enables deep cellular penetration, enhancing its Therapeutic effects. In the treatment of Rheumatoid Arthritis, it facilitates targeted delivery to inflamed joints. Gold Nanoparticles derived from Swarna Bhasma have been shown to reduce the proportion of cancer cells, specifically Hela Cells (Breast cancer Cells), while efficiently delivering drugs without causing toxic effects. These nanoparticles encapsulate drug , ensuring increased efficacy without toxicity to human cells, even at Higher doses. Imaging studies, such as SEM and Dark Field Hyperspectral Imaging, revealed that very small doses of Swarna Bhasma easily penetrate cancer cells. Additionally, it demonstrated therapeutic efficacy in treating RA by acting on Anti-Nuclear Antibodies (ANA) and reducing symptoms. Furthermore, Gold nanoparticles regulate cellular proliferation in Michigan Cancer Foundation (MCF-7) cells, confirming their role as a potent anti-cancer agent.

Results: This review reveals significant gaps in the literature, particularly in elucidating the molecular pathways involved in Swarna Bhasma's therapeutic

actions. A better understanding of these pathways is necessary to expand its application in different therapeutic forms.

Keywords: Swarna, Gold Nanomedicine, Anti-Inflammatory activity, Immunomodulatory activity, Anti- Tumor activity, Hela cells, MCF-7 cells, Drug Delivery, Nanoparticles.

Exploring the Therapeutic Potential of Swarna Bhasma as Gold Nanomedicne and its Application

INTRODUCTION

Ayurvedic has always utilized gold, which is what Swarna Bhasma is composed of. Rasaratna Sammuchya, Rasa Prakasha Sudhagar, Ayurveda Prakasha, Rasatarangini, Rasamritam, and other classical texts are cited in relation to Swarna Bhasma. For the metal gold in the classics, the following Synoyms were used: Swarna, Suvarna, Dravina, Hiranya, Kalyanaka, Kancana, Agnivarna, Manohara, Hema, Bhusana, Agnibija, Kanaka, Kounta, Bhrngara, Mangalyaka, Jambava, Jambunada, Bharma, Jatarupa, Campeyaka, Lohavara, Rukma, and Hataka. The first Suddha loha is Swarna (Gold). Gold, which has the atomic number 79 and the symbol Au, is a dense, soft, lustrous, malleable, and ductile metal. One ounce may be hammered into 300 square feet, or one gram can be beaten into a sheet of one square meter.It is possible to beat gold leaf till it is transparent. Pure gold retains its brilliant yellow hue and sheen, which are historically regarded as beautiful, in both air and water without oxidizing. Under normal circumstances, it is one of the least reactive chemical elements and is solid. Although gold is resistant to many acids, it can be dissolved by aqua regia, also known as nitro-hydro chloric acid, which gets its name from the fact that it dissolves gold. Acid cyanide solutions, which have been employed in mining, also dissolve gold. When gold dissolves in mercury, amalgam alloys are created. The acid test gets its name from the fact that gold is insoluble in nitric acid, which dissolves silver and base metals. This property has long been employed to verify the existence of gold objects. Gold strongly reflects infrared radiation and conducts heat and electricity well.

Because of its chemical invulnerability to air, moisture, and the majority of corrosive reagents, it is ideally suited for usage in jewelry and coinage as well as a protective layer for other, more reactive metals. It is not chemically inert, though[1].

To ensure a thorough and balanced grasp of the subject, the evaluation was carried out by searching academic books, reliable websites, scholarly publications, and classic literature. In addition to Ayurvedic pharmacopoeia of India, the texts include Rasaarnavam, Rasendra mangala, Rasa chudamani, Rasa prakasha sudhakara, Rasa ratna samucchaya, Sharangadhara samhita, Rasa

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chintamani, Rasa sara sangraha, Rasa tarangini, and Rasamritam. It was gathered from Pubmed and other articles that were found by searching for Swarna, Suvarna, Gold, Swarna Bhasma, and Incinerated Gold Ash. Madhura rasa and Snigdha guna are found on Swarna Bhasma's property. It enhances quality of life and has aphrodiasic effects when taken internally sparingly. In pumsavana sanskara, it is helpful. It increases physical resistance and counteracts the negative effects of numerous toxins. In Kshaya rogas and Vishama Jwara, it is helpful. It enhances hunger and balances the Vata dosha. It strengthens the body, nourishes the roots of the hair, and treats a host of other illnesses. Because it functions as nanomedicine, herbal mineral preparations like Swarna Bhasma are superior methods of administration.

Properly prepared *Swarna bhasma* should comply with the classical parameters. They include Ayurvedic parameters such as *Rekhapurnatva* (~easy lodging of *Bhasma* particles in the furrows of the fingers), *Varitaratwa* (~floating overwater), *Nirdhoomata* (~smokelessness), *Dantagre kacha* (~gritty particle feeling between teeth), *Varna* (~color), *Niswadu* (~tasteless), *Nishchandratvam* (~lusterless), and *Apunarbhava* (~inability to revert back to its metal form).Swarna Bhasma is usually prescribed with honey, ghee, or milk. It has focused on determining the effectiveness of *Swarna Bhasma* for regulating cellular proliferation[2]. *Swarna Bhasma* does not have any significant impact on the viability of HeLa and HFF-1 cell lines depicting its nontoxic nature in our body or at least in some cell lines. However, it shows moderate and dose-dependent toxicity to michigan cancer foundation-7 (MCF-7) breast cancer cells and could act as an anti-breast cancer agent. Oral administration of *Swarna Bhasma* on albino mice showed no significant toxicity as studied with the help of liver function tests and histological studies.

The anti-inflammatory and immunomodulatory properties of Swarna Bhasma have been extensively studied in the context of RA. Experimental studies have demonstrated that Swarna Bhasma exhibits inhibitory effects on pro-inflammatory cytokines and mediators, thereby attenuating the inflammatory response associated with RA. Additionally, the immunomodulatory actions of Swarna Bhasma have been linked to the regulation of immune cells, including T cells and macrophages, further supporting its potential as a therapeutic intervention for autoimmune disorders. the nanoparticulate nature of Swarna Bhasma has been implicated in its enhanced bioavailability and targeted delivery. Nanoparticles possess unique physicochemical properties that can facilitate cellular uptake and improve drug delivery to specific tissues. In the case of Swarna Bhasma, its nanoscale dimensions may contribute to its ability to penetrate biological barriers and exert therapeutic effects at the cellular level. This aspect becomes particularly relevant in the treatment of RA, where targeted delivery to

2

inflamed joints is crucial for optimal therapeutic outcomes[3].

Some Gold salts do have anti- inflammatory properties and are used as pharmaceuticals in the treatment of arthritis and other similar condition. It has been utilized as a therapeutic agent in the Indian System of Medicine for several clinical disorders including Bronchial Asthma, Rheumatoid Arthritis, Diabetus mellitus and disorders of nervous system. Nanomedicine is a cutting edge interdisciplinary field that utilizes nanotechnology along with treatment and prevention of disease at the cellular dimension. Nanomedicine holds great promise in addressing various challenges in health care, including Targeted Drug Delivery. The researchers aim to enhance the efficiency and specificity of Therapeutic agent. It exhibits enhancing Drug Delivery, Bioavailability and therapeutic efficacy[4]. Gold Nanoparticles (Swarna Bhasma, Gold Ash) have been used for its therapeutic benefits as far back as 2500B.C With advancement in nanotechnology, Swarna Bhasma is now being explored as a nanoparticles with therapeutic applications.The Gold ash, swarna bhasma is prepared through a process called Putapaka, which involves high temperature (1000C) will be called as Incinerated Gold Particles (IAuPs). The spectroscopic measurement of IAuPs around 50-70nm in size. It appears Red Brown Powder which aggregate to form agglomerates of 2-25 micrometer. Interstingly, the gold content varies different Swarna Bhasma Preparation. IAuPs from large clusters that enter cells providing a large surface area for the potential delivery of drugs. Its extremely important to evaluate the cytotoxicity of gold nanoparticles and their internalization, prior to using therapeutic application.

IAuPs efficiently target and accumulate in cancerous cells as their dosage increases. Smaller doses, still can reach the cancer cells. Therefore, the therapeutic effect of IAuPSs varies according on its size, shape, and surface area3. Investigating possible anti-tumor agents is now the most active field of IAuP development. IAuPs are administered with acceptable safety and efficacy, particularly in human breast cancer. There have been several references to the medicinal effectiveness of Swarna Bhasma as Incinerated Gold Nanoparticles. These include anti-inflammatory, anti-oxidant, anti-arthritic, anti-angiogenic, neuroprotective, anti-microbial, and anti-tumor effects. The purpose of this study is to investigate the potential therapeutic uses of Swarna Bhasma as a gold nanomedicine, with an emphasis on how well it works in different therapeutic domains5.

Gold based injection have been explored as a means to help to reduce the pain and swelling of rheumatoid arthritis and tuberculosis. Research shows gold nanoparticles (AuNPs) are efficient in delivering drugs without showing toxic effects as they can encapsulate drugs. it is yet to be validated if the Swarna Bhasma prepared according to

3

4

Ayurvedic principles also maintains the same efficacy in terms of drug delivery as AuNPs. Proangiogenic heparin-binding growth factors (HB-GFs) are said to be inhibited by IAuPs, which act as antiangiogenic activity. It also showed that in order to limit the activity of HB-GFs and the ensuing intracellular signaling processes, the gold surface is necessary and core size is significant. Additionally, research shown that IAuNPs' inhibitory action results from the nanoparticles' modification of HB-GFs' conformation or configuration, while non-HB-GFs' conformations are unverified.

The GNPs are suitable candidates for nanomedicine because of their immunogenic effects on RAW 264.7 macrophage cells, which showed that they are not cytotoxic, reduce the production of reactive oxygen and nitrite species, and do not elicit the secretion of pro-inflammatory cytokines Tumor Necrosis factor-α (TNF-α) and Interleukin 1-β (IL 1-β). Swarna Bhasma efficiently targets and accumulates in malignant cells, as demonstrated by its interaction with human cells (HFF-1) and cancerous cells (HeLa).

An evaluation of the effectiveness of Swarna prashana and Swarna vacha prashana was carried out in a single-blind clinical research with healthy newborns. According to the study, Swarna Prashana can minimize morbidity and promote newborn health. Furthermore, research have shown that the administration of Swarna bhasma did not affect the newborns' normal growth or anthropometrical or biochemical markers. Additionally, it demonstrated immunomodulatory efficacy, and the infants accepted it without experiencing any negative side effects during the trial or follow-up period. However, IAuPs enter HeLa cells more readily when they are smaller particles. However, larger particles seem to gather in subcellular spaces.

CONCLUSION

Swarna Bhasma possesses strong Anti-Inflammatory and Immunomodulatory properties. It modulates immune cells and prevent Autoimmune disorder. Gold Nanoparticles derived from Swarna Bhasma have been shown to reduce the proportion of cancer cells, specifically Hela Cells (Breast cancer Cells which act as Anti- Tumor activity. But smaller particles IAuPs enter HeLa cells more easily. But Larger particles appear to accumulate in subcellular location Swarna prasha contained Gold nanoparticles has Anti- Microbial activity has highly beneficial. It acts therapeutic efficacy in treating RA by acting on Anti-Nuclear Antibodies (ANA) and reducing symptoms.

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