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ORIGINAL ARTICLE

Hibiscus sabdariffa synthesized gold nanoparticles ameliorate aluminum chloride induced memory deficits through inhibition of COX-2/BACE-1 mRNA expression in rats

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Abstract Alzheimer's disease (AD) is a major health challenge worldwide, especially among the elderly. The disease is associated with cognitive and memory deficits. This study investigated the effect of *Hibiscus sabdariffa* synthesized-gold nanoparticles (HS-AuNPs) on $AlCl_3$-induced memory deficits in rats. Forty-two male Wistar rats were divided into six groups (n = 7). Group I served as control. Rats in group II - V were exposed to $AlCl_3$ (100 mg/kg) to induce AD. Group III - V rats were treated with 5 mg/kg donepezil, 5 and 10 mg/kg HS-AuNPs, respectively, for 14 days. Behavioral tests were carried out on the rats on day 28 and 42. At the end of animal experiment, rats were sacrificed and used for various biochemical assays and gene expression. The AD rats showed memory and learning impairment, and these conditions were ameliorated by HS-AuNPs. Significant ($p < 0.05$) elevation in the activities of acetylcholinesterase, monoamine oxidase and adenosine deaminase, as well as malondialdehyde levels was noted. A significant reduction in the activities of superoxide dismutase (SOD), glutathione peroxidase (GPx) and reduced glutathione (GSH)

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Novel Pharmaceutical Nanomaterials to Advance the Current Breast Cancer Treatment – Current Trends and Future Perspective

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7.1 Introduction

The current conventional cancer therapy is limited because it kills cancerous as well as normal cells, leading to side effects such as anemia, discomfort, vomiting, weight fluctuations, and loss of hair. Over the years, research and development of cancer therapy has focused on nanoparticles, receptor targeting molecules, and antibodies for better cancer treatment. Nanocarrier systems such as antibody (Ab)–drug conjugates, micelles, liposomes, dendrimers, nanoemulsions, and polymeric nanoparticles have a clinical advantage over conventional chemotherapy as they aid in decreasing the side effects of anticancer drugs [1]. Designing targeted drug delivery systems enables passive or active targeting of nanoparticles to reach the cancer site. Liposomes (50–200 nm) were first developed in 1964 by Bangham and Horne, followed by FDA approval of the liposomal formulation of doxorubicin (Doxil®) for ovarian cancer in 1965 and later for breast cancer [2].

Since then, several anticancer formulations have been successfully formulated, including DaunoXome®, Depocyt®, Myocet®, Mepact®, Marqibo®, or Onivyde™[3]. Liposomes are spherical vesicles prepared from a naturally derived phospholipid (nontoxic, non-immunogenic, and biodegradable) consisting of one or more lipid bilayers with discrete aqueous spaces [4]. For enhanced permeability and retention effect (EPR), the liposome can be designed to have triggered drug release in response to pH, enzymes, light, electromagnetic field change, and heat (e.g. ThermoDox® – Lysolipid thermosensitive liposomal doxorubicin) [5]. Various organic and inorganic nanomaterials used in cancer are illustrated in Table 7.1. Apart from using nanoparticles as drug delivery systems, the use of inorganic nanoparticles expands the application of nanotechnology in cancer management. The clinically approved Hensify® (hafnium oxide nanoparticle),

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