ANTITUMORAL EFFICACY OF GOLD NANOPARTICLES WITH POLYPHENOLS IN BREAST CANCER AND METASTATIC CELLS *IN VITRO*

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Introduction and objective: Gold nanoparticles (AuNPs) present beneficial properties in cancer diagnosis and therapy, as they can be coated and biofunctionalized with bioactive molecules through surface modification using relatively non-toxic reagents, enabling the reduction of metal ions, stabilization, and selective detection of cellular receptors [1]. The reduction of gold by phytochemicals to form nanoparticles represents promising methods in Green Nanotechnology. This study aims to compare the binding capacity and evaluate the antiproliferative potential of gold nanoparticles coated with tannic acid (TA-AuNPs) against human breast tumor cell lines. Cytotoxicity was determined using the MTS method.

Methodology: The synthesis of TA-AuNPs was established through the chemical reduction, and the purification method was based on centrifugation, where the centrifuged sample (P1) was resuspended after removing and storing the supernatant (S1), thus generating three samples, including the non-centrifuged (NC). The confirmation of TA-AuNPs formation was achieved by UV-Visible absorption spectroscopy, and the size determination of TA-AuNPs was carried out using dynamic light scattering and Transmission Electron Microscopy (TEM) techniques. The Zeta potential was used to determine the stability of TA-AuNPs. Human breast adenocarcinoma cell lines (MCF-7 and MDA-MB-231) were used, and the cytotoxicity determination was performed using the MTS assay.

Results and discussion: The synthesis of TA-AuNPs showed a change in color, indicating the formation of spherical AuNPs. UV-Visible analysis was performed for preliminary characterization, where the absorption band at a wavelength of 529 nm, correlated with the localized surface plasmon resonance band, indicates the presence of approximately 20 nm AuNPs in all samples.

To evaluate the size of TA-AuNPs, the samples were analyzed using the dynamic light scattering method. The hydrodynamic diameters measured indicate that centrifugation induces greater aggregation of the AuNPs. However, based on the polydispersity values ranging from 0.087 - 0.186, the AuNPs showed uniform sizes.

The Zeta potential was an effective indicator used as a criterion to classify and quantify stability, with the samples exhibiting magnitudes above 40 mV, indicating high stability.

TEM images confirmed the presence of TA-AuNPs in the samples and provided information about their dimensions, around approximately 20 nm with spherical morphology.

The cytotoxicity assessment for validating TA-AuNPs demonstrated that the coating plays a crucial role in the degree of internalization, and a higher quantity of specific receptors resulted in a greater internalization of TA- AuNPs. It was observed that there was a higher percentage of cell viability in MCF-7 cells compared to MDA-MB- 231 cells.

Conclusions: The synthesis was efficient in obtaining TA-AuNPs. The TA-AuNPs showed a narrow size distribution, predominantly spherical morphology, and low PDI, indicating significant potential for biomedical applications in the healthcare field. The results satisfactorily and efficiently demonstrated that TA-AuNPs are effective against breast cancer cells (MCF-7) and exhibit higher efficiency in targeting metastatic breast cancer cells (MDA-MB- 231), highlighting their significant potential for various medical applications in the field of nanomedicine.

References:

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