Effects of gold nanoparticles on SKBR3 breast cancer and CRL-4010 non cancer cells

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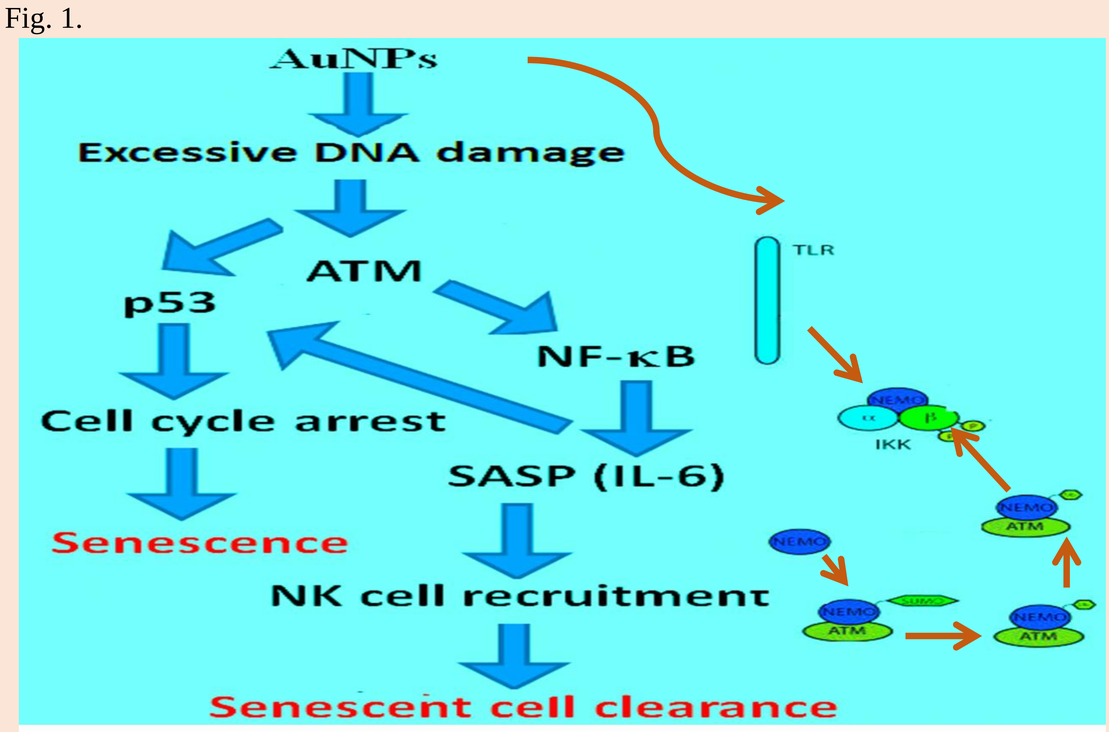
1. Abstract

In this work, a cefdinir capped gold nanoparticles (Au-NPs) were synthesized to check the effects of these nanoparticles on SKBR3 cells. These nanoparticles have demonstrated decreased cell viability and expanded cytotoxicity in SKBR3 breast cancer cells as compared to CRL-4010 (control) with concentrations of 0, 50, 100, 150, 200 µg/mL, respectively were determined by flow cytometry. When p53 protein level was increased in SKBR3 then the NFkB was decreased in the treated SKBR3 cells. Flow cytometry results displayed that cell viability of SKBR3 breast cancer cells was considerably decreased when cells were exposed to Au-NPs at concentration levels of 0-200 µg/mL. In brief, we conclude that these gold nanoparticles have anticancer potentiality, but further studies are mandatory to confirm our preliminary findings.

2.Introduction

Breast cancer constitutes almost 23.1% of all female cancers. Breast cancer cases account for 11-15% of all cancer cases in the USA [1]. Cancers of the colon, rectum, anal canal and anus, and leukemia were the second and third most frequently seen cancers, respectively. Cancer progression and malignant growth is related to activation of caspases (CASPs) in Fig. 1.



In our hypothesis, effect of gold nanoparticles (AuNPs) can be effective on the expression levels of p53 in breast cancer line (SKBR3) and mammary epithelial cell line (CRL-4010).

3. Material and Methods

a. **Preparation of AuNPs:** AuNPs has been synthesized with the help of antibiotic drug and then has been characterized by various techniques such as UV Visible, FTIR, SEM, TEM and XRD. At the end we had application of it on SKBR3 breast cancer and breast normal cells.

b. **Cell culture:** Breast cancer cell line (SKBR3) and immortal breast epithelial cell line (CRL-4010) (LGC Promochem, Teddington, UK) were cultivated. At the end of 24 hours, the cells were harvested for total RNA isolation.

c. **Gene expression analysis:** cDNA was collected using reverse transcription assay kit (Qiagen, Germany). Gene expression levels of CASP, 3, 8, 9 p53, NFkB and the b.actin (housekeeping gene).

d. **Statistical study:** Collected data were analyzed using Corbet Rotor-Gene software. Fold change ($2^{-\Delta\Delta Ct}$) values among 0.1 to 0.5 were measured as significant downregulation while >2.0 was measured significant upregulation. The expression levels of CASPs, p53 and NFkB genes were compared with the expression levels of CASPs, p53 and NFkB genes in breast cancer cell line (SKBR3) compared to mammary epithelial cell line (CRL-4010).

4. Results and Discussion

Real-time PCR (qRT-PCR) was used to measure the expression level of CASPs after the treatment of AuNPs. We observed that CASPs expression levels in SKBR3 breast cancer cell line was decreased due to AuNPs. While on the other hand expression levels of CASPs in SKBR3 breast cancer cell line were increased. In addition, the upregulation of p53 and simultaneous downregulation of NF-kB after AuNPs treatment suggested the presence of a crosstalk between these two important cellular pathways. This is one of the pioneer studies in its uniqueness and it depicts an association between the NFκB, p53 and CASPs after the treatment of AuNPs (Fig. 1&2).

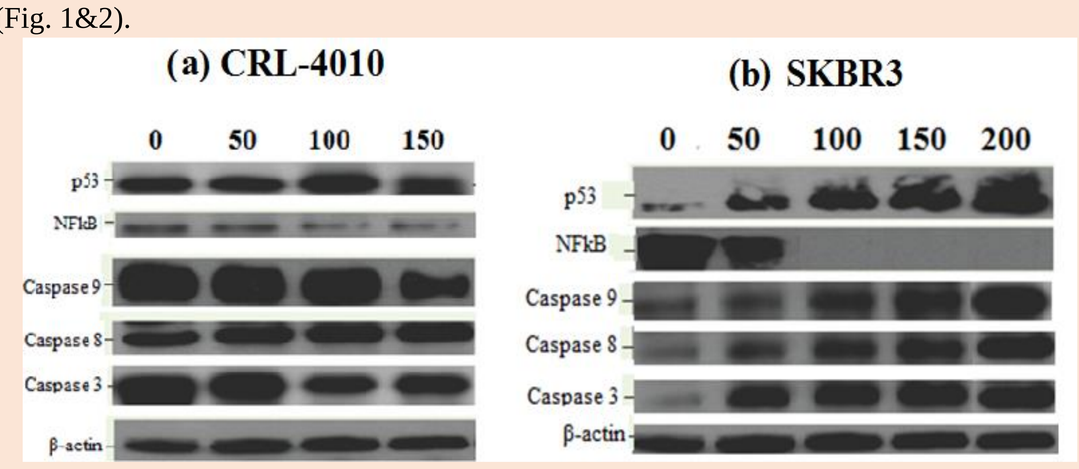


Fig 1. AuNPs stimulates the p53 activation and inhibition of NfκB protein expression in SKBR3. Western blotting of AuNPs treated (a) CRL-4010 control breast cells and (b) SKBR3 breast cancer cells represent p53 dependent apoptosis induction via caspase cleavage. Each experiment was performed at least 3 times.

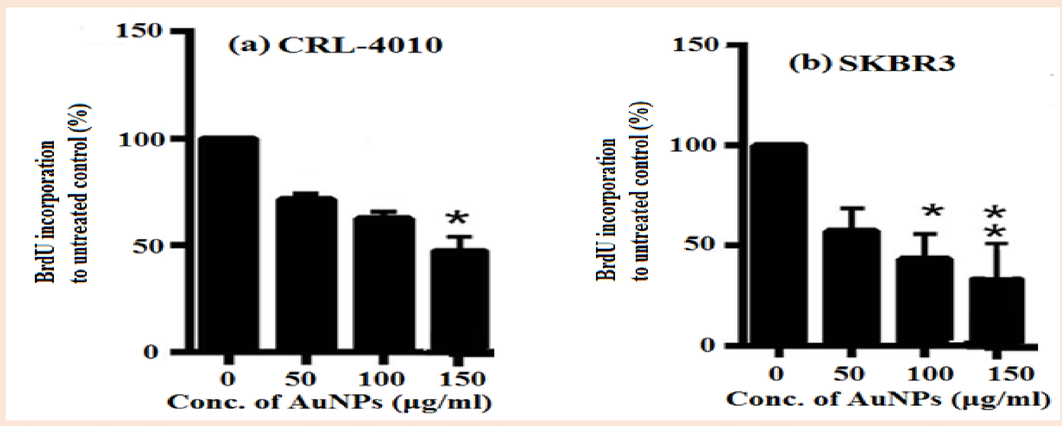


Fig.2. Reduced breast cancer cell proliferation following AuNP treatment. Cell proliferation activity of (a) CRL-4010 (breast cells) and (b) SKBR3 (breast cancer cells) and was detected using BrdU incorporation in FACS analysis. Each column bar represents the mean value with error (SD) of three sets of experiments. *P≤0.01, and**P≤0.001.

5. Conclusion

Cancer progression and malignant growth is related to activation of caspases (CASPs). In recent studies CASPs are considered as novel treatment regime in breast cancer. Real-time PCR (qRT-PCR) was used to measure the expression level of CASPs after the treatment of AuNPs. We observed that CASPs expression levels in SKBR3 breast cancer cell line was decreased due to AuNPs. While on the other hand expression levels of CASPs breast cancer cell line were increased. In addition, the upregulation of p53 and simultaneous downregulation of NF-kB after AuNPs treatment suggested the presence of a crosstalk between these two important cellular pathways. Our results demonstrated that expression levels of NFκB, p53 and CASPs genes can be modified following the treatment of AuNPs.

References

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