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Plant peptide lectin-coated gold nanoparticles cytotoxicity against targeted tumor associated carbohydrate antigen expressed in cancer cell lines: A potential application in drug delivery

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Cancer cells lines demonstrate the abnormal expression of O-glycan structures called as Tumor associated carbohydrate antigens (TACA) synthesized by specific glycosyl transferases. These carbohydrates present on tumor cell surfaces are different than those present on normal cells. The TACA's are candidate biomarkers for targeted drug delivery of chemotherapeutic agents. Initiation of tumor and metastasis is marked by changes in cell surface glycosylation, expression of increased level of a tumor associated carbohydrate antigens, high sialylation and insufficient phosphorylation. The most important disadvantage of chemotherapeutic agents is their non specificity and toxicity to normal cells in addition to cancer cells. This can be overcome by application of chemotherapeutic drugs coupled with proteins with high specificity for tumor associated carbohydrate antigens. Lectin is a common non immunological protein derived from plants that is capable of binding and recognizing the glycoproteins which are present on the surface of the cell. The cell surface carbohydrates interact with lectins to form the cell-specific binding moieties. These carbohydrates moieties can be used for specific targeted drug delivery system for lectins (lectin direct targeting). Specific carbohydrate present on tumor can be targeted and anticancer effect may be achieved. In the present study, biostabilized gold nanoparticles coated with plant peptides and lectin proteins derived from *Pisum sativum* and *Brassica oleracea* were synthesized. *Pisum sativum* contains a number of proteins like α - and β -pisavins, albumins, miraculins and mannose- and glucose-binding lectins. The presence of lectin protein was confirmed by FTIR and SDS-PAGE. The targeted anticancer activity was studied using MTT assay. The biostabilized gold nanoparticles demonstrated greater vitro anticancer activity against HeLa and HEK cancerous cell lines in comparison to only plant extract and chemotherapeutic agent as control as evidenced by MTT assay. The damage to DNA of the apoptotic cancerous cells was visualized by propidium iodide fluorescent staining. Furthermore, comet assay was performed to confirm the apoptotic/necrotic damage to nucleic acid of the tumor cells. Lectin-based targeted cytotoxicity of nanoparticles is a potential field in drug delivery and can provide new avenues for nanotherapeutics.

Biography

Rebecca Thombre is an Assistant Professor in the Dept. of Biotechnology, Modern College, Pune affiliated to University of Pune, India. She was the gold medalist in M.S. (Microbiology) at University of Mumbai (Bombay) and has pursued her Ph.D. at Agharkar Research Institute, An autonomous body of Department of Science and Technology, Government of India. She has a teaching experience of 12 years in affiliated colleges of University of Mumbai and Pune and a past research experience at IIT, Bombay and Agharkar Research Institute, Pune. Her doctoral research is on Cyclodextrin glycosyl transferase from extremophiles isolated from soda lake of Lonar, India. She has published more than 50 research articles including peer reviewed papers, abstracts, book chapters and posters and popular articles. She is currently pursuing her research on Biological synthesis of Nanoparticles and its application in cancer (Funded by Board of College and University Development (BCUD), University of Pune and University Grants Commissions (UGC), New Delhi). Her post doctoral research focus is on Halophiles: model organisms for studying Life in outer space, funded by Indian Space Research Organisation (ISRO). She is also engaged in discussions and deliberations in her own group of Nanotechnology at Scitable, published by Nature Publishing group.

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