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A novel immunoanalytical method for obesity biomarker detection using antibody functionalized silver nanoparticles

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Obesity is a serious health issue related with increased body fat content. Escalating numbers of patients have been reported worldwide throughout the recent past, associated with a high cost in the healthcare sector. Other than being a disease condition by itself, it also acts as a risk factor for many metabolic and cardiovascular diseases. There is no definitive treatment available and control of the disease is achieved via lifestyle modifications; hence, early detection of the risk to be obese is of paramount importance. Nevertheless, accurate diagnostic methods for obesity are not widely available in the current clinical setting due to the high cost and associated drawbacks. Utilization of 'leptin', which is an accurate indicator of body fat content, has gained the attention of researchers as a biomarker for obesity.[1] Therefore, this study was conducted with the aim of developing a novel immunoassay for the detection of leptin; a biomarker for obesity.

Leptin detection was done using an immunoanalytical method by surface functionalization of silver nanoparticles using anti-leptin antibodies.[2] Silver nanoparticles were synthesized by reduction of silver nitrate using sodium borohydride. Prepared silver nanoparticles were characterized using UV-Vis spectroscopy, dynamic light scattering (DLS) and scanning electron microscopy (SEM). The SPR peak was found to have a λ_{max} of 405 nm with a FWHM of 72 nm and the average particle size was recorded as 40 nm. Bovine serum albumin (BSA) was used to stabilize the synthesized silver nanoparticles sterically and the optimum BSA concentration required was found to be 10 µg/ml. Synthesized nanoparticles were surface functionalized using anti-leptin antibodies which specifically bind with leptin. These antibody-nanoparticle conjugates were characterized by a currently used immunoassay technique named Enzyme Linked Immunosorbent Assay (ELISA), UV-Vis spectroscopy and SEM and corresponding data verified the successful functionalization. Optimum pH and antibody-nanoparticle ratio for this functionalization process were determined using ELISA and according to obtained results, pH 9.5 and 1:10 ratio were selected to be the best conditions. Detection principle of this novel assay was based on the immuno-aggregation of anti-leptin functionalized silver nanoparticles in the presence of leptin. Changes in surface plasmon resonance due to this leptin induced aggregation were manifested via UV-Vis spectroscopy and spectral changes in the absorption peak confirmed the leptin detection ability.

This nanoparticle based detection system could be used as an intermediate detection step for qualitative analysis of samples as positive or negative for leptin. It could be further developed as a novel method to measure body fat content thereby allowing the early diagnosis of the risk towards obesity. This study gives insight to a promising alternative method to existing detection methods which are more expensive and time consuming.

Keywords
Obesity, leptin, Silver nanoparticles, anti-leptin antibodies

References

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