Development of competitive lateral flow immunoassay coupled with silver enhancement for simple and sensitive salivary cortisol detection

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Abstract

Cortisol is known as a stress biomarker. The measurement of cortisol levels is an early warning indicator for health conditions and diagnosis of stress-related diseases. Herein, a lateral flow immunoassay using a gold nanoparticle label with a silver enhancement system was developed for the simple, sensitive and rapid detection of cortisol. The developed assay was based on a competitive platform of which cortisol-BSA conjugate was immobilized at the test zone to compete with an analyte. The quantitative analysis was performed using gold nanoparticles (AuNPs) as signal labeling. Sequentially, the silver enhancement solution was applied in order to enhance the sensitivity of the assay with the results easily seen by the naked eye. Using this system, the limit of detection (LOD) was found to be 0.5 ng/mL with a 3.6 fold more sensitive detection than without the enhancement system (LOD = 1.8 ng/mL). The salivary cortisol analysis was in the range of 0.5-150 ng/mL (R^2 = 0.9984), which is in the clinical acceptable range. For the semi-quantitative analysis, the intensity color of the results was analyzed using an image processing program. The proposed method was successfully applied to detect cortisol in saliva. In addition, the results from our method also complied with the ones of those obtained by using the commercial enzyme-linked immunosorbent assay (ELISA). This developed assay offers great promise for a non-invasive screening test of salivary cortisol.

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