An Investigation on Starch-Stabilized Silver Nanoparticles on Detection of Proteinuria and Hyperphosphatemia

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Purpose: Chronic Kidney Disease (CKD), a condition of characterized gradual loss of kidney function, lowers the glomerular filtration rate of its patient. As protein in urine is regarded as an independent marker of the severity of CKD, and the two proteins are cysteine-containing proteins, we investigated on the effectiveness of detection of CKD by starch-stabilized silver nanoparticles. Procedure: 1% starch solution is used as the solvent of silver nitrate to prepare starch-stabilized silver nanoparticles in situ by the reduction of sodium borohydride solution. Silver nanoparticles test papers were prepared by drying filter papers soaked in silver nanoparticles solution. Real human urine sample and modified urine samples were dropped to the silver nanoparticles solution and its derived test paper. Photos were taken on the resultant solution. Results: A higher concentration of starch and sodium borohydride produced silver nanoparticles with more even size, proven by TEM. A higher concentration of cysteine-containing proteins (Cys>9.38 ppm) in urine leaded to a more deepened color of the reaction mixture. A higher concentration of phosphate in urine leaded to a less deepened color of the reaction mixture. Conclusions: This study showed that starch-stabilized silver nanoparticles and its derived products can be used as a less time-consuming method to identify the severity of CKD of a person, which has a lower cost and a wider range compared to the dipstick test papers commonly adopted in clinical pathology practice nowadays.

Awards Won:
American Statistical Association: Certificate of Honorable Mention