Institutionen för Biovetenskaper och Näringslära

Assessment of DNA damage, oxidative stress and inflammation in chronic kidney disease patients – and a clinical study of a dietary supplement

AKADEMISK AVHANDLING
som för avläggande av medicine licentiatexamen vid Karolinska Institutet offentligen försvaras i Seminarierum grön, vån 6, Novum, Huddinge.

Måndagen den 30 januari, 2012, kl. 10.00

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Stockholm 2012

Abstract

Decreased kidney function is associated with higher levels of oxidative stress, inflammation and malnutrition. Chronic kidney disease (CKD) patients have a higher risk to develop cardiovascular disease, atherosclerosis and cancer compared to the general population. Cardiovascular disease is the major cause of death in CKD patients. Many CKD patients also report oral health problems including dry mouth symptoms, inflammation in the oral cavity and changes in the salivary constitution. These alterations can increase the systemic inflammation. CKD patients are often also deficient in several vitamins, due both an impaired kidney function, depletion during dialysis and decreased nutritional intake. In this thesis, including two clinical studies on CKD patients, levels of oxidative stress, inflammation, saliva production and blood markers were investigated. Oxidative stress was measured by analysis of oxidative DNA damage in salivary glands using the comet assay.

Paper I: The objective was to assess the levels of DNA damage in salivary gland biopsies, saliva production and inflammation in 79 CKD patients and compare the levels to controls. The relationships between the study parameters were investigated and the results for predialysis and dialysis patients were compared. The results showed that the dialysis patients had lower levels of DNA breaks and that predialysis patients had higher levels of DNA breaks compared to their controls. The saliva production was found to be lower in the dialysis patients compared to the control group as well as the predialysis group. The inflammation levels were found to be higher in CKD patients compared to the controls. Previous studies have shown raised levels of DNA damage in peripheral blood mononuclear cells (PBMCs) from CKD patients. The results from this study suggest that the DNA in peripheral tissue in dialysis patients is affected differently.

Paper II: The objective was to investigate the effects of oral supplementation with sea buckthorn oil (SBO) on oxidative stress, saliva production and inflammation in hemodialysis patients. Sea buckthorn is rich in polyunsaturated fatty acids, vitamins and other phytochemicals. Positive health effects by SBO on dry eye symptoms, platelet aggregation and skin diseases have been reported. The 45 hemodialysis patients completed the 2 x 8 weeks placebo-controlled crossover study and the results did not show any effects on DNA damage, inflammation or saliva production. However, the levels of phosphate and sodium increased and iron levels decreased after SBO supplementation. The results from this study did not show any positive health effects of SBO supplementation on DNA damage, saliva production or inflammation.

In conclusion; oxidative stress and inflammation are important risk factors that contribute to disease progression and mortality in CKD patients. The interrelations between these events are complex and factors including dialysis treatment, medication, diet and oral health are of importance. In our study we found that despite elevated systemic inflammation, the levels of DNA damage in salivary glands in dialysis patients were lower compared to controls. The results suggest the involvement of DNA repair and antioxidative mechanisms in this tissue. Supplementation with SBO did not show any reduction on DNA damage or inflammation in dialysis patients, concluding that SBO supplementation did not have any beneficial health effects in our study group.