

Nuclear microscopy investigation of induced atherosclerotic lesions of rabbits fed with a high cholesterol diet and Zn supplements

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Inflammation and oxidative processes are considered key issues in the progression of atherosclerosis, from fatty streak formation to plaque rupture and thrombosis. There is evidence that zinc requirements of the vascular endothelium are increased during the inflammatory conditions such as atherosclerosis.

In our study, New Zealand White rabbits fed on a high cholesterol diet were divided into two groups. The rabbits in the test group received a high cholesterol diet with Zn supplements for 8 weeks and the rabbits in the control group were fed only with a high cholesterol diet for the same period of time. Tissue sections from both groups were taken from the aortic arch, flash frozen and air-dried for nuclear microscopy studies. Serial tissue sections were mounted on slides for H&E histochemical staining and lesion area analysis.

Lesion area analyses using light microscopy showed that the average lesion area taken over cross sections of artery wall was 1.00mm² for the test models compared with 3.01mm² for the control group models ($P = 0.0045$). Elemental analysis of the lesion and adjacent artery wall using Nuclear Microscopy with the combination of Scanning Transmission Ion Microscopy (STIM), Rutherford Backscattering Spectrometry (RBS) and Proton Induced X-ray Emission (PIXE) showed that the zinc level remained the same for both the lesion and the artery wall for both test and control models, whilst the iron levels are reduced from 43.3ppm to 30.6 ppm (in the lesion) and from 16.7ppm to 5.6ppm (in the artery wall). This raises the possibility that zinc may act as an endogenous protective factor against atherosclerosis.