

Accumulation of Maillard Reaction Products in Skin Collagen in Diabetes and Aging

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Abstract

To investigate the contribution of glycation and oxidation reactions to the modification of insoluble collagen in aging and diabetes, Maillard reaction products were measured in skin collagen from 39 type 1 diabetic patients and 52 nondiabetic control subjects. Compounds studied included fructoselysine (FL), the initial glycation product, and the glycoxidation products, *N*^ε-(carboxymethyl)lysine (CML) and pentosidine, formed during later Maillard reactions. Collagen-linked fluorescence was also studied. In nondiabetic subjects, glycation of collagen (FL content) increased only 33% between 20 and 85 yr of age. In contrast, CML, pentosidine and fluorescence increased fivefold, correlating strongly with age. In diabetic patients, collagen FL was increased threefold compared with nondiabetic subjects, correlating strongly with glycated hemoglobin but not with age. Collagen CML, pentosidine and fluorescence were increased up to twofold in diabetic compared with control patients: this could be explained by the increase in glycation alone, without invoking increased oxidative stress. There were strong correlations among CML, pentosidine and fluorescence in both groups, providing evidence for age-dependent chemical modification of collagen via the Maillard reaction, and acceleration of this process in diabetes. These results support the description of diabetes as a disease characterized by accelerated chemical aging of long-lived tissue proteins. (*J. Clin. Invest.* 1993. 91:2463–2469.) Key words: aging • collagen • diabetes • glycation • oxidation