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Effects of Glycation on Erythrocyte Carbonic Anhydrase-I and II in Patients With Diabetes Mellitus

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Abstract: In order to investigate the effect of high blood glucose levels of long duration on carbonic anhydrase, and to evaluate the relation of the enzyme to its inhibitors in uncontrolled Type 1 diabetic patients, erythrocyte CA -I and CA-II activities and their kinetic parameters were determined. The effects of glycation on erythrocyte carbonic anhydrase-I and II (CA-I and CA-II) in patients with Type-I diabetes mellitus (uncontrolled) were investigated using kinetic parameters. After blood glucose and hemolysate total esterase activity levels had been measured in both 10 control and 10 diabetic subjects, CA-I and CA-II in hemolysate were purified separately by affinity chromatography. The enzyme activity, fructosamines, V_{max} , K_M , and K_i values of CA-I and CA-II were determined. The means of the blood glucose and hemolysate total esterase activity levels were significantly higher in the diabetics than in the controls ($p < 0.001$). After purification, the means of the enzyme activity, fructosamines, and V_{max} values of both CA-I and CA-II were significantly higher in the diabetics than in the controls ($p < 0.01$ $p < 0.001$ and $p < 0.01$) respectively, while the K_M values exhibited no significant differences ($p > 0.05$). The means of the K_i values of both CA-I and CA-II, using acetazolamide and sulfanilamide inhibitors, were significantly lower in the diabetics than in the controls ($p < 0.001$). Glycation was found to increase both CA activity and the inhibitory effect of acetazolamide and sulfonamide on CA activity. Since CA is a well-known enzyme regulating pH in most of the tissues in the body, changes in CA activity may be associated with metabolic diseases, especially in diabetes mellitus. Therefore, dosages of CA inhibitors should be considered carefully in the treatment of diabetic patients.

Key Words: Carbonic anhydrase, glycation, enzyme kinetics.

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