Research Journal of Medical Sciences 4 (3): 199-203, 2010
ISSN: 1815-9346

Evaluation of DNA Fragmentation in Leukocytes of Type I Diabetic Patients

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Abstract: The current study was carried out to evaluate the degree of DNA fragmentation that might happen in leukocytes due to diabetes mellitus. Twenty blood samples were obtained from fasting normal and type I diabetic patients subjected to regular analysis at Jeddah Regional Laboratory. The plasma samples are evaluated for blood glucose level while leukocytes are used for determination of DNA fragmentation by both spectrophotometric and electrophoretic methods. Samples of non-diabetic subjects revealed normal blood glucose levels <120 mg dL^{-1}. At the same time, samples of diabetic patients showed significant hyperglycemia >120 mg dL^{-1}. The results of determination of DNA fragmentation levels showed high percentages (as measured by OD) of diabetic samples in comparison to the samples of normal patients. The results of spectrophotometric determination are confirmed by determination of DNA fragmentations in leukocytes by agarose gel electrophoresis and image analysis of fragmented DNA where they are increased in diabetic patients. It is concluded that type I diabetes has a deleterious effect on DNA which may be due to production of reactive free radicals. Therefore, it is recommended that diabetic patients should be advised to administer antioxidants in their treatment.

Key words: DNA fragmentation, diabetes, type I, leukocytes, ROS, antioxidants

INTRODUCTION

Diabetes mellitus, often referred to simply as diabetes is a syndrome of disordered metabolism usually due to a combination of hereditary and environmental causes, resulting in abnormally high blood sugar levels (hyperglycemia) (Tierney *et al*., 2002). Diabetes mellitus refers to the group of diseases that lead to high blood glucose levels due to defects in either insulin secretion or insulin action in the body (Rother, 2007). Diabetes develops due to a diminished production of insulin (type 1) or resistance to its effects (in type 2 and gestational) (WHO, 1999; Department of Noncommunicable Disease Surveillance). Diabetic Ketoacidosis (DKA) is an acute and dangerous complication results from low insulin levels that cause the liver to turn to fat for fuel (i.e., ketosis). Ketoacidosis (much more common in type 1 diabetes than type 2) can easily become severe enough to cause hypotension, shock and death.

Adler *et al.* (2000) stated that chronic elevation of blood glucose level leads to damage of blood vessels (angiopathy). The endothelial cells lining the blood vessels take in more glucose than normal, since they don't depend on insulin. They then form more surface glycoproteins than normal and cause the basement membrane to grow thicker and weaker. In diabetes, the resulting problems are grouped under microvascular disease (due to damage to small blood vessels) and macrovascular disease (due to damage to the arteries). Carotid artery stenosis does not occur more often in diabetes and there appears to be a lower prevalence of abdominal aortic aneurysm. However, diabetes does cause higher morbidity, mortality and operative risks with these conditions (Weiss and Sumpio, 2006).

Diabetic encephalopathy (Aristides and Rayaz, 2007) is the increased cognitive decline and risk of dementia observed in diabetes. Various mechanisms are proposed including alterations to the vascular supply of the brain and the interaction of insulin with the brain itself (Gispen and Biessels, 2000).

As a result of these complications, many literatures have concluded that diabetes may have a suspected effect on DNA level of the cells (Maruo *et al*., 2001; Honma *et al*., 2003; Kumar *et al*., 2007; Xu *et al*., 2008). Therefore this study is planned to focus on estimation of the level of DNA fragmentation in blood cells of type I diabetic patients to through more light on the effect of

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