Is $F_2$-isoprostane a biological marker for the early onset of type 2 diabetes mellitus?

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Aim: This clinical study was undertaken to investigate whether $F_2$-isoprostane, a prostaglandin $F_2$-like compound derived from the non-enzymatic peroxidation of arachidonic acid, could serve as a novel biomarker for early detection of type 2 diabetes mellitus (T2DM) or its complications. Materials and Methods: Twenty-five individuals who had impaired glucose tolerance (IGT) or T2DM were compared with controls. Anthropometry, plasma glucose, hemoglobin A1c, lipid profile and $F_2$-isoprostane levels were measured in these subjects. Results: Clinical characteristics of subjects with IGT showed significant alteration when compared to subjects with T2DM but not with that of controls having normal glucose tolerance. In the case of isoprostane levels, there existed a significant difference between groups but there is no clear correlation with the clinical characteristics of the subjects. Conclusion: Isoprostane may not serve as a marker for early detection of diabetes. However, its value may predict the oxidative status of the subjects and hence the development of the complications associated with diabetes.

KEY WORDS: Impaired glucose tolerance, isoprostanes, normal glucose tolerance, type 2 diabetes mellitus

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Introduction

Diabetes is one of the most common non-communicable diseases globally. It is either the fourth or fifth leading cause of death in most developed countries. It is one of the most challenging health problems faced by many developing and industrialized countries. The cause of type 2 diabetes mellitus (T2DM) is insulin resistance and relative insulinopenia. One of the foremost challenges we face is to account mechanistically for the myriad other biochemical and physiological abnormalities characteristic of this disease. These abnormalities include central obesity, hypertension, accelerated atherosclerosis, hypertriglyceridemia and low serum concentrations of high density lipoproteins.

Isoprostanes, a new class of biologically active products of arachidonic acid metabolism, are emerging as potentially relevant to human vascular disease. Besides providing a likely index of lipid peroxidation in this setting, measurements of specific $F_2$-isoprostanes in urine may provide a sensitive biochemical endpoint for dose-finding studies of natural and synthetic inhibitors of lipid peroxidation. $F_2$-isoprostanes are prostaglandin like compounds formed in vivo from free radical catalyzed peroxidation of arachidonic acid, via a non-cyclooxygenase dependent mechanism. $F_2$-isoprostanes are found in the body tissues in the esterified form, and in biological fluids such as plasma and urine in the free form. Enhanced formation of $F_2$-isoprostanes has been associated with several cardiovascular risk factors including hypertriglyceridemia and diabetes mellitus that are characterized by increasing lipid peroxidation and in response to other abnormalities such as atherosclerosis. Among the 15 series of isoprostanes, $F_2$-isoprostanes possess more marked biological functions such as vasoconstriction, stimulating mitogenesis, enhancing monocytes and polymorphonuclear cell adhesion to endothelial cells and inducing endothelial cell necrosis. This led us to focus our interest on $F_2$-isoprostanes rather than other isoprostanes.