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The Association of Fasting Plasma Glucose and HbA1c in Type-2 Diabetes mellitus Patients: Implications for Glycaemic Control

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Abstract: ***The dramatic increase in the incidence and prevalence of type-2 diabetes mellitus in both developed and developing worlds, putting pressure on healthcare resources, and will be more impacting on the developing world. Diabetes management often started later in the disease due to the asymptomatic nature of the disease , currently the available approach to the management of this disorder include lifestyle changes and hypoglycaemic medications present some shortcomings that keep the patient asking "Isn't there anything new to manage my diabetes"(1) Glycaemic control traditionally relies on the measurement of fasting plasma glucose(FPG) now replaced with the glycated haemoglobin measurement and it is the gold standard as it offers more advantages over the traditional fasting plasma glucose measurement. Objectives: The present study is to determine the correlation between fasting plasma glucose and glycated haemoglobin in type-2 diabetes mellitus patients and its implications for better glycaemic control. Methods: In a retrospective cohort design the data of 395 known type-2 DM patients attending Asian Institute of Gastroenterology who had their HbA1c and FPG determined was analyzed to determine the carl Pearson correlation co-efficient(r) for the HbA1c and FPG. Results: shows that The result shows that the mean age of patients in this study is 51-56±10, the mean FPG is 137±50, and the mean HbA1c is 7.5%±1.5%. (see table 1) The Carl Pearson correlation co-efficient between HbA1c and FPG r=0.609. Conclusions: The positive correlation between HbA1c and FPG in type-2 diabetes mellitus patients suggest the importance of FPG as second line test for the blood glucose monitoring in resource limited settings most commonly found in developing countries.***

Keywords: HbA1c, Fasting plasma glucose, Type-2 diabetes mellitus.

1. Introduction

Diabetes identified by persistent hyperglycaemia is the leading chronic metabolic disorder leading to complications that may be acute and long-term. Persistent hyperglycaemia impairs water and electrolyte balance and energy utilization resulting in diabetic symptoms of polyuria and polydypsia(2) others include dehydration, weight loss, cerebral dysfunction, coma and complications in blood vessels and nerves. The number of diabetic patients in the world currently, there are 246 million people worldwide (2)and may reach 380 million by the year 2025.the dramatic rise in incidence and prevalence of this disorder has been attributed to various factors including; genetic predisposition and environmental factors. The most prevalent is type-2 diabetes mellitus (also called Non-insulin dependent diabetes mellitus NIDDM) or adult onset diabetes account for approximately 90-95% of diabetic people in the west.(3) the asymptomatic nature of the disease, showing no apparent clinical presentation result in vast majority of those living with type-2 diabetes undiagnosed. the primary therapeutic goal for type-2 diabetic patient is the maintenance of normal blood glucose, lipid and blood pressure levels, to achieve these goals, lifestyle modification has been the first and basic approach being cheap and without major side-effects (4) monitored traditionally using the conventional fasting plasma glucose measurement which has now been replaced with gold standard that is the HbA1c measurement. The present study is to determine the correlation between HbA1c and fasting plasma glucose in type-2 diabetes mellitus patients.

2. Literature Survey

The most prevalent type – 2 diabetes, which makes up 95% of the diabetics in the world, this dramatic increase in prevalence may be attributed to various factors including, genetic predisposition, favoring environmental factors: such as excessive calorie intake, obesity and sedentary habit. Patients with this disease have significantly high risk of developing life – threatening complications such as, nonketotic hyperosmolar coma, heart disease, stroke, limb amputation, kidney disease, blindness and may also lead to premature death. (5) these complications are often the result of sustained hyperglycemia due to improper management of the disease.

2.1 Pathophysiology

Type 2 diabetes (also called non- insulin dependent diabetes mellitus- NIDDM-or adult onset diabetes) occurs in approximately 90 – 95 % of diabetic people in the western world, (3) and 95% of diabetic people in India characterized by hyperglycemia, resulting from insulin resistance and insufficient compensatory insulin secretion. The diagnosis of the disease due to various genetic and acquired factors, leading to the elevation of blood glucose concentration in to the diabetes range is based on the criteria set by the American Diabetic Association (6).

2.2 Risk Factors

Type – 2 diabetes mellitus is strongly favored by both genetic and environmental factors the genetic predisposal although it shows familial aggregation as well as high

concordance (80%)in monozygotic twins, its mode of inheritance is not fully understood (3) studies has reported relative heritability of this disease, which was estimated to be approximately 50% (7). Additionally, recent genome – wide association studies, have found over 40 loci that is diabetes – associated. (8) Therefore the risk of offspring and siblings of type – 2 diabetic parents to develop the disease is relatively elevated and this point to the important role the genetic factor play in the risk of type – 2 diabetes. Similarly, favoring environmental factors; excessive calories intake, obesity with increased body fat in the abdominal (Visceral) site, lifestyle (Sedentary habit), old – age, smoking as well as low socioeconomic status are known risk factors for type – 2 diabetes (9). Ethnicity seems to play a role in the increased risk of type – 2 diabetes and this may be attributable to genetic and/or environmental factors; ethnic groups including African – American, South Asian, Hispanic and Aboriginal peoples have shown increased risk of type – 2 diabetes in contrast to their Caucasian counterpart. Additionally, dietary factors aimed at normalizing blood glucose, have also shown protective role on diabetes risk while some diets are associated with increased risk e.g sugar-sweetened beverages, processed meat. (10).

2.3 Methods

In a retrospective cohort design study, the medical record of 395 known diabetic patients enrolled at Asian Institute of Gastroenterology Hyderabad from January, 2013 to December, 2013 who had their HbA1c determined by Ion-exchange HPLC and fasting plasma glucose using automated enzymatic method.

2.4 Statistical Analysis

The statistical version SPSS 16.0 was used to determine the mean and SD of HbA1c and FPG, the MS-Excel was used to determine the Carl Pearson correlation co-efficient between HbA1c and FPG.

RESULTS: The result shows that the mean age of patients in this study is 51-56±10, the mean FPG is 137±50, and the mean HbA1c is 7.5%±1.5%. (See table 1) The Carl Pearson correlation co-efficient between HbA1c and FPG r=0.609.

Table 1: Shows the measure of dispersion of the three parameters, age, FPG and HbA1c.

Age		*FPG*		*HbA1C*	
Mean	SD	Mean	SD	Mean	SD
51	10.1	143	56.5	7.7	1.6
51	9.8	132	41.6	7.4	1.4
56	10.94	135	52.9	7.4	1.5

Table 2: Shows correlation co-efficient between HbA1c and FPG

	r	Total
Correlation between HbA1c and fasting plasma glucose	0.609	395

3. Discussion

The Health status of individuals of any nations may depends on the economic status of the state, resource allocation to the healthcare, knowledge and understanding of the role of environment in the epidemiology of the disease. The maintenance of normal blood glucose and freedom from hyperglycaemia to avoid complications is of utmost importance; as such controlling the blood glucose with any possible mechanism is the primary goal for the management of this disorder. Even though insulin secretion and insulin action has been known to be the cause of type-2 diabetes mellitus, the hormone insulin seldom use in routine clinical practice, rather a measure of the blood glucose traditionally by the conventional Fasting plasma glucose and now with the HbA1c which is the gold standard.

From the result of this study the mean age of diabetic patients enrolled in this study is 53±10 years, and the mean fasting plasma glucose is 137±50 mg/dl, and the mean HbA1c is 7.5%±1.5%.shows that the participant have a high blood glucose in the diabetic region according to the American Diabetic Association criteria (FPG≥126mg/dl) same also hold for the level of HbA1c (HbA1c≥6.5%) this qualifies the subject as diabetic and fit for the inclusion in this study.

The most important finding of this study is that HbA1c positively correlates with Fasting plasma glucose(r=0.609)this means that with every increase in blood glucose level there will be a corresponding increase in glycated haemoglobin, this finding agrees with the finding of Van't Rift et al 2010 that shows there is positive correlation between HbA1c and FPG. The HbA1c is the test of choice and gold standard for the blood glucose monitoring being more precise and specific requiring no patient preparation, limited individual variation as oppose to FPG, and is more reflective of diabetic complications than FPG, with all these advantages in resource limited settings commonly found in developing countries the measurement of HbA1c being more expensive and technical than FPG may not be feasible, as such positive correlation between HbA1c and FPG (r=0.609) suggest that FPG may still be use as alternative method for blood glucose monitoring in type-2 diabetes mellitus patients.

4. Conclusions

The positive correlation between HbA1c and FPG in type-2 diabetes mellitus patients suggest the importance of FPG as second line test for the blood glucose monitoring in resource limited settings most commonly found in developing countries.

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