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ORIGINAL ARTICLE

Effects of Glycemic index on Glucose 6 Phosphate Dehydrogenase (G6PD) in Type-2 Diabetes Mellitus

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ABSTRACT

Background: Diabetes Mellitus is one of the alarming health hazardous indicator and with poor glycemic control, it will be dangerous for human health because it is more prone to development of different systemic & vascular complications. G6PD is one of the carbohydrate metabolic enzyme which prevent from oxidative stress and development of free radicals.

Objective: The purpose of this research is to evaluate the level of G6PD in patients of type-2 diabetes mellitus with their different levels of glycemic control index.

Methodology: This study was done at Department of Biochemistry LUMHS in collaboration with Diabetic clinic LUMHS and Diagnostic & Research Laboratory LUMHS Jamshoro. Total 100 diagnosed cases of type-2 diabetes were selected and divided into three groups with different categories of glycemic control index. The HbA1c% was measured by Bio Red Variant while G6PD was measured by standard G6PD quantitative measurement method at Diagnostic laboratory LUMHS using assay kit (SD Biosensor, Inc. Republic of Korea).

Results: The G6PD significantly ($p < 0.05$) decline in diabetic patients with poor glycemic control having mean values of HbA1c% between 11-13%.

Conclusion: This research study concluded that there is significant decline in G6PD in patients of diabetes mellitus with poor glycemic control. Estimation G6PD also can use as screening test in diabetic population to determine their genetic involvement.

Keywords: Type-2 Diabetes Mellitus, HbA1c%, G6PD

INTRODUCTION

Hexose Monophosphate (HMP) shunt is the pathway of carbohydrate metabolism which produce NADPH compound by the action of Glucose -6- Phosphate Dehydrogenase (G6PD) which is highly redox potential against free radicals injury. NAD^+compound reduce and covert into NADPH when G6PD enzyme oxidized into Glucose-6-Phosphate.[1,2] This reduction of NAD to NADPH is beneficial for the tissues like liver, mammary glands, adipose tissues and adrenal gland where biosynthesis of fatty acids and isoprenoid compound has been occured.[3,4] Basically G6PD is regulatory enzyme of HMP shunt and plays important role against oxidative stress and free radical injury.[5] Type-2 Diabetes Mellitus is also one of the leading clinical misadventures which develop oxidative stress and production of free radicals at different tissues and cause serious macro & micro vascular complications like diabetic neuropathy, nephropathy, angina, myocardial infarction, diabetic retinopathy, diabetic cataract etc.[6,7,8] The increase amount of NAD^+can take part in synthesis of saturated fatty acids which may accumulate in the tunica of blood vessels and lead to life hazardous vascular complications discussed earlier.[9] So G6PD convert large amount of $NAD^+$to its reduced form NADPH to prevent these atherosclerotic complications in diabetic population.[10]The normal reference range of G6PD in blood is10.15–14.71 U/g Hb for neonates and 6.75–11.95 U/g Hb for adults.[11]In this study we have estimated the G6PD levels at different glycemic index in diabetic patients. More than 400 million population of world suffered from the deficiency of G6PD. This study aims to conduct the research to estimate the level of G6PD at different levels of type-2 diabetes with their glycemic control index.

METHODOLOGY

This case comparative study was done at the Department of Biochemistry Liaquat University of Medical & Health Sciences Jamshoro with collaboration of Diabetic Clinic LUMHS & Diagnostic & Research Laboratory of LUMHS. Total 100 diagnosed cases of type-2 diabetes mellitus were selected for this study with their own consent. The sampling was done on Non-Probability type of sampling. These all subjects were divided in to three groups as group A contained 35, group B contained 33, group C contained 32 diagnosed cases of type-2 diabetes. Group A recruited those diabetic patients which had HbA1c% level between 7 – 9 %, in group B diabetic patients which hbA1c% levels between 9-11% while group C had diabetic patients with HbA1c% between 11-13% means poor glycemic control. The diagnosed cases of type -2 diabetes mellitus between age 40 to 50 years male & females were included while known case of type-I diabetes, cases of type-2 diabetes having age less than 40 years or more than 50 years, type-2 diabetic patients on insulin therapy, history of cardiac diseases, history of chronic inflammatory systemic disease cases of pulmonary tuberculosis, rheumatoid arthritis were excluded from this study. The HbA1c% was measured by Bio Red Variant while G6PD was measured by standard

G6PD quantitative measurement method at Diagnostic laboratory LUMHS using assay kit (SD Biosensor, Inc. Republic of Korea). The data was statistically analyzed by SPSS version 21.

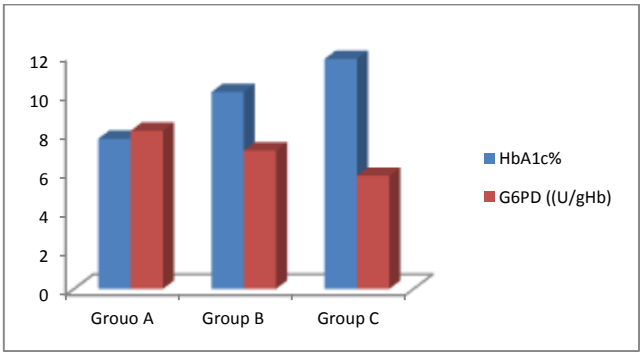
RESULTS

This research proposal contained 120 subjects of diagnosed cases of type-2 diabetes mellitus divided in to three groups, each group contained 40 subjects but with different glycemic control index as mentioned at portion of methodology.

Table no:01 shown the relation and mean values of G6PD with glycemic index HbA1c% at different varieties with their significance by application of independent student t test. This table shows that level of G6PD significantly decreased ($p< 0.05$) in group of diabetic patients with poor glycemic control.

Table 1: G6PD levels in comparison of different levels of HbA1c%

Group	HbA1c%	G6PD (U/gHb)	P. Value
A (HbA1c = 7-9%)	7.6 ± 0.7	8.11 ± 1.1	0.015
B (HbA1c = 9-11%)	10.1 ± 0.4	7.1 ± 1.4	0.247
C (HbA1c = 11--13%)	11.8 ± 0.5	5.8 ± 2.13*	<0.05



Graph 1: G6PD levels in comparison of different levels of HbA1c%

The above results clinched that the level of G6PD significantly decline with poor glycemic control or it can be decline in uncontrolled diabetes mellitus.

DISCUSSION

G6PD is the rate controlling enzyme of Hexose Monophosphate Shunt that act in the conversion of glucose-6-phosphate to 6- phosphate gluconate, which is the first step for the synthesis of NADPH compound.[5]G6PD is the only source of NADPH at red blood cells against oxidative stress.[12]The deficiency of G6PD also observed in hemolysis, heavy inflammatory agents, neonatal jaundice and drug induces especially drugs used in treatment of malaria.[13,14]

The relation of G6PD with diabetes is still under discussion. There are different hypothesis like some researchers suggested that G6PD deficiency occur due to increased blood glucose level or increased in poor hypoglycemic control some suggested that the diabetes can occur due to deficiency of G6PD.

The deficiency of G6PD has been observed at African and Asian tropical and subtropical regions of the world. Around 5-30% of Asian population is suffering from deficiency of G6PD.[15] The deficiency of G6PD causes decrease production of NADPH compound, due to this decline in NADPH causes the increase level of oxidative stress and also activates the production of free radicals which can lead damage in vascular tone, integrity of different organs. These all events mostly observed in poor glycemic control state.[1,2]

The goal of this study was to determine the levels of G6PD in diabetics at various degrees of glycemic control. G6PD levels have been seen to decrease with poor glycemic control when HbA1c levels consistently surpass 11 to 12 %, according to our findings. Our study supported by findings of Pinna A et al (2009),[16] who concluded that in Italian population G6PD levels decreased in poor glycemic control especially when vascular complications has start to develop. Jordon LC et al (2011)[17] also observed the deficiency of G6PD in the patients of diabetes & diabetic complications.Sheng Su et al (2015)[18] reported that G6PD significantly decline in diabetic as well diabetic complicated population. Our result does not correlate with Ashur et al (2016) [19] they reported that G6PD levels that significantly did not decrease in diabetic population.

This study has a few limitations, such as the need for larger sample sizes, data from several regions, and work on G6PD status in both types I and II diabetes mellitus.

CONCLUSION

This research study concluded that there is significant decline in G6PD in patients of diabetes mellitus with poor glycemic control. Estimation G6PD also can use as screening test in diabetic population to determine their genetic involvement.

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