ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Total Antioxidant Status and Its Relation to Glycemic Control.

Mythili SV, and Jamuna Rani A*.

Department of Biochemistry, Sree Balaji Medical College & Hospital, Bharath University, Chennai, Tamil Nadu, India.

ABSTRACT

Diabetes Mellitus is a metabolic disorder primarily affecting the Carbohydrate metabolism where Glucose is underutilized, leading to hyperglycemia and may be associated with oxidative stress. This study was undertaken to underline the role of antioxidants in the glycaemic control among diabetic subjects. Ninety three -93(male 48, female 45) patients with Type 2 diabetes in the age group of 30-50 yrs attending the Diabetic OP of Sri Balaji Medical College & Hospital were recruited for the study and were compared with eighty eight (88) age and sex matched healthy controls (male 33 and female 55). The sum of endogenous and food derived antioxidants represents the total antioxidant status of an individual. Cayman's antioxidant assay was used to measure the total antioxidant status of plasma, in the control and diabetic group. Glycohemoglobin was estimated by Ion exchange resin method. Total antioxidant status (TAS) was significantly decreased among diabetic subjects in comparison to healthy controls. Glycohemoglobin of the diabetic subjects was above normal range. Moderate negative correlation of Glycohemoglobin and (TAS) among our study population shows that whenever the Glycated hemoglobin levels were high the total antioxidant status decreases and vice versa. As the results of the study clearly show that TAS is very much affected with poor Glycaemic control, Measures to replenish the antioxidants exogenously could help in Glycaemic control.

Keywords: Type 2 Diabetes, Oxidative stress, Total antioxidant status, Glcohemoglobin

Corresponding author

ISSN: 0975-8585

INTRODUCTION

Diabetes Mellitus is a metabolic disorder primarily affecting the Carbohydrate metabolism where Glucose is underutilized, leading to hyperglycemia. [1]A study by Ramachandran *et al* has shown increased incidence of diabetes among Chennai population .This rise is attributed to the change in lifestyle resulting from 100% urbanization and industrialization leading to less exercise, more fast food culture and oxidative stress. [2]Oxidative stress is the price we pay for using oxygen. Reactive oxygen species (ROS) are the sparks of the oxidative metabolism. [3] ROS are generated under physiological conditions and are thought to be the signaling molecules for the expression of ROS specific scavengers [4]. They are also involved in defense mechanisms as seen in phagocytosis, neutrophil function, and shear-stress induced vasorelaxation. Excess generation of ROS in oxidative stress has pathological consequences including damage to proteins, lipids and DNA. [5]

In the absence of an appropriate compensatory response from the endogenous antioxidant network, the system becomes overwhelmed with increased oxidants (redox imbalance), leading to the activation of stress-sensitive signaling pathways, such as NF-κ_B, p38 MAPK,(Mitogen activated protein kinase) JNK/SAPK (CJun N terminal kinase/Stress activated Protein kinase) (PKC, AGE/RAGE,(Advanced Glycation end products/Receptor for advanced Glycation end products) sorbitol, and others. The consequence is the production of gene products, such as Vascular Endothelial Growth Factor (VEGF) and others, which cause cellular damage and are ultimately responsible for the long-term complications of diabetes. [6]

Enhanced glycation, oxidation and glyoxidation of lipoproteins have been postulated as a possible cause for the development of micro vascular disease. [7] Lipid peroxidation and antioxidant enzymes in blood have been cited as markers for vascular injury/microangiopathy in DM in several studies. [8-12]

Total antioxidant status

Reactive oxygen species (ROS) are produced as a consequence of normal aerobic metabolism. Unstable free radical species attack cellular components causing damage to lipids, proteins and DNA which can initiate a chain of events resulting in the onset of a variety of diseases. Living organisms have developed complex antioxidant systems to counter ROS and to reduce the consequent cellular damage. These antioxidant systems include enzymes such as superoxide dismutase, catalase, and glutathione peroxidase, macromolecules such as albumin, cerruloplasmin and ferritin: and an array of small molecules including ascorbic acid, α tocopherol, β carotene, reduced glutathione, uric acid and bilirubin [13].

MATERIALS AND METHODS

A total of ninety three -93(male 48, female 45) patients with Type 2 diabetes in the age group of 30-50 yrs attending the Diabetic OP of Sri Balaji Medical College & Hospital were recruited for the study and were compared with eighty eight (88) age and sex matched healthy controls (male 33 and female 55).4ml venous blood was drawn in the fasting condition from the patients, 1ml transferred into tube with oxalate-fluoride mixture for Fasting Plasma Glucose (FPS) and 1ml to heparinized tube for estimation of Glycated Hemoglobin (HbA_1C) and remaining sample was transferred into plain tubes for assay of Total antioxidant status.

The assay is based on the ability of antioxidants in the sample to inhibit the oxidation of ABTS (2, 2' Azino-di-(3-ethylbenzthiazoline sulphonate) to ABTS*(radical cation).

Cayman's antioxidant assay was used to measure the total antioxidant capacity of plasma,in the control and diabetic group. Aqueous and lipid soluble antioxidants are not separated in this protocol, thus the combined antioxidant activities of all its constituents including vitamins , proteins, lipids, glutathione, uric acid, are assessed. The assay relies on the ability of antioxidants in the sample to inhibit the oxidation of ABTS(2,2' Azino-di-(3-ethylbenzthiazoline sulphonate) to ABTS*by metmyoglobin. The amount of ABTS* produced is read at 405 nm. Under the reaction conditions used the antioxidants in the sample cause suppression of the absorbance at 405nm to a degree which is proportional to their concentration.

ISSN: 0975-8585

RESULTS AND DISCUSSION

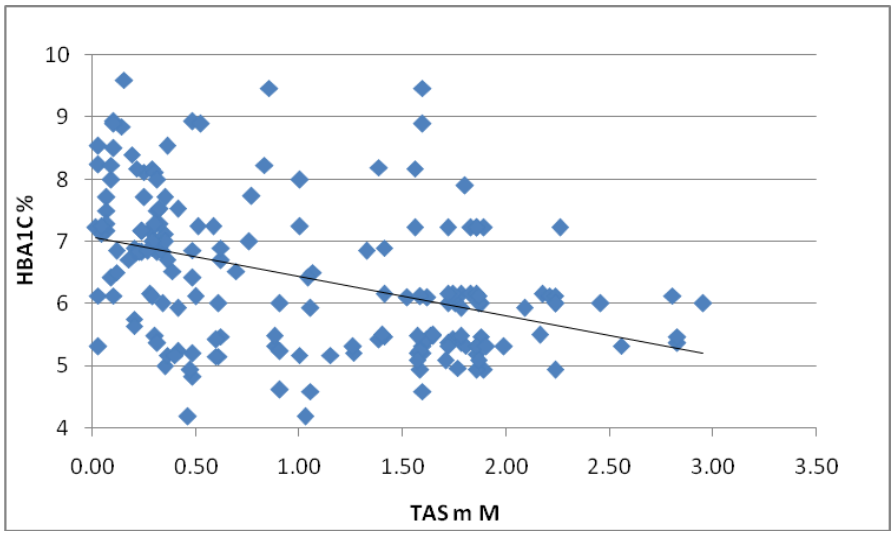
The Normal Glycated Hemoglobin levels according to ADA criteria range from 4-5.6%. HbA1C of 6.5% or more is considered Diabetic levels. Glycated Hemoglobin levels expressed as Mean ± S.D in Diabetic patients of our study was 7.22 ± 1.03 whereas in healthy controls it was 5.61± 0.64. The levels show a significant difference between Cases and controls.

In our study, there has been decreased total antioxidant status among diabetic cases as 0.46 +/-0.46 mM whereas the healthy controls had a value of 1.69 +/- 1.34 mM. This decrease among diabetic subjects could be attributed to increased oxidative stress as evidenced by lipid peroxidation, increased protein glycation and increased free radical generation. A study from South Karnataka on individual antioxidants among diabetics reported a significant decrease of erythrocyte GSH as well as decrease of other antioxidants reflecting the overwhelming adaptive response to the challenge of oxidative stress in the diabetic state with or without complications [14]. Baynes and Thorpe proposed a greater role for overload of metabolic pathways as the primary culprit in oxidant stress in this condition [15] .Several studies have revealed lowered antioxidant and enhanced peroxidative status in diabetes condition. [16-21]

Table 1: Pearson's correlation of Total antioxidant status vs Glycated Hemoglobin

Pair	Study population	
	r value	p value
TAS vs HbA1c	-0.33	0.68

TAS vs HbA_{1C}: moderate negative correlation among our study population,
r value is -0.33



Graph No 1

CONCLUSION

Tight Glycemic control of Diabetic subjects will help them maintain their Total antioxidant status in near normal levels and thereby the damages due to oxidative stress could be minimized.

REFERENCES

[1] Tietz Text book of Clinical Biochemistry-Carl A.Burtis & Edward R.Ashwood-III Edition.pg.776.
[2] Ambady Ramachandran, Snehalatha C, Vijay V, King H. Diabet Med 2002; 19: 130
[3] Medical Biochemistry John W Baynes. Marek H Dominicizak second edition pg 506.
[4] Benoît D'Autréaux and Michel B. Molecular Cell Biology 2007;8:813.

[5] Jeanette Schultz Johansen, Alex K Harris, David J Rychly and Adviye Ergul. Cardiovascular Diabetol 2005;4:5
[6] Bucala R, Makita Z, Koschinsky T,et al. Proc Natl Acad Sci USA 1993;90:6434-6438.
[7] Emina olak, Nada Majki-Singh. JMB 28: 63–71, 2009
[8] Kalairanam K,Dharmalingam M,Marcus SR. Int J Diab Dev Cltries 2006;26:30-32.
[9] Ahmed FN,Naqvi FN,Shafiq F. Ann NY Acad Sci 2006;1084:481-489.
[10] Sampath KR,Balasubramanyam M,Tara C,Rema M,Mohan V. Mol Cell Biochem 2006;282:169-176.
[11] Ramakrishna V, Jailkhani R. Diagn Pathol 2007;2:22.
[12] King GL. J Periodontol 2008; 79:1527-1534.
[13] Barry Halliwell. Free Rad Rev 25(1):57-74.
[14] Baynes JW, Thorpe SR. 1999;48:1-9.
[15] Kalairanam K, Dharmalingam M, Marcus SR. Int J Diab Dev Cltries 2006;26:30-32.
[16] Ahmed FN, Naqvi FN, Shafiq F. Ann NY Acad Sci 2006;1084:481-489.
[17] Sampath KR, Balasubramanyam M, Tara C,Rema M, Mohan V. Mol Cell Biochem 2006;282:169-176.
[18] Ramakrishna V, Jailkhani R. Diagn Pathol.2007;2:22.
[19] King GL. J Periodontol 2008; 79:1527-1534.
[20] Robby Kumara, Sakil Ahmed. Int J Cur Bio Med Sci 2011; 1(4): 147 – 148.
[21] Uzun H, Zengin K, Taskin M, Aydin S, Simsek G, Dariyerli N. Obes Surg 2004;14:659 – 665.