



## **EFFECTS OF LYCOPENE COMPUND ON OXIDATIVE STRESS TO REDUCE THE RATE OF CARDIAC COMPLICATIONS IN TYPE – II DIABETES MELLITUS**

**\*Ali Raza Memon<sup>1</sup>, Hina Riaz<sup>2</sup>, Keenjhar Rani<sup>2</sup>**

<sup>1</sup>Department of Biochemistry Liaquat University of Medical & Health Sciences (LUMHS) Jamshoro, Sindh, Pakistan

<sup>2</sup>Department of Physiology Liaquat University of Medical & Health Sciences (LUMHS) Jamshoro, Sindh, Pakistan

### **ABSTRACT**

The objective of the present study is to evaluate the beneficial effect of tomatoes, which are rich source of Lycopene, relatively a new carotenoid known to play an important role in human health and disease. In this study the levels of serum enzymes involved in antioxidant activities like Super Oxide Dismutase, Glutathione Peroxidase, Glutathione Reductase, Reduced Glutathione, in type-II diabetic group (n = 30) and control group (n = 30), and observed significantly lower levels of antioxidant enzymes in type-II diabetes when compared to control group (p<0.001). Short term supplementation with tomatoes (cooked) to diabetic group for a period of 21 days, showed a significant improvement in antioxidant enzyme levels suggesting the supplementation with tomato lycopene may serve as the best method of preventing the oxidative stress in diabetic patients.

**Key words:** Tomato lycopene, Super Oxide Dismutase, Catalase, Reduced Glutathione, Glutathione Reductase, Glutathione Peroxidase.

### **INTRODUCTION**

Diabetes Mellitus is one the major problem all over the world especially it highly affect the cardiovascular system which will cause increase rate of mortality and morbidity [1]. Changes in life style and obesity are the main exploratory factors of diabetes mellitus type – II [2]. The burden of diabetes upon developing countries is higher like Pakistan, China etc. Lycopene is recently discovered as carotenoid compound which is highly present in red color pulp of tomatoes. It is beneficial in prevention of coronary artery diseases [3-5]. It is a highly unsaturated hydrocarbon containing eleven conjugated and two unconjugated double bonds. It is the most predominant carotenoid in human plasma present naturally in greater amount than  $\beta$ -carotene and other dietary carotenoids. This perhaps indicates its greater biological significance in human antioxidant defense system [6]. Due to high blood glucose levels Reactive oxygen species (ROS) are formed which cause the oxidative stress in diabetic patients [7]. There is strong evidence that the damage caused by ROS may play a significant role in causation of secondary symptoms in diabetes like neuropathy, nephropathy and retinopathy etc. Changes in oxidative stress biomarkers, including

Superoxide dismutase (SOD), Catalase (CAT), Glutathione reductase (GR), Glutathione peroxidase (GSH-Px) [8]. Antioxidants are protective agents that inactivate Reactive Oxygen Species (ROS) and thereby significantly delay or prevent oxidative damage. The role of dietary antioxidants including Vitamin-C, Vitamin-E and  $\beta$ -carotenes in disease prevention has received much attention in recent years [9]. But very recently it also stated that lycopene also work as potent antioxidant [10].

### **MATERIAL & METHODS**

This study was carried out at Department of Biochemistry of Liaquat University of Medical Health Sciences Jamshoro Sindh Pakistan. 30 subjects which were healthy persons were enrolled as control group, 30 subjects were diagnosed cases of diabetes type-II having no any history of neuropathy, retinopathy, nephropathy and cardiac diseases etc. All the subjects under study having age b/w 40 – 55 years, they all were non smokers. Take 3ml of blood sample from every subject for analysis the biomarkers of oxidative stress like Superoxide dismutase (SOD), Catalase (CAT), Glutathione reductase (GR), Glutathione peroxidase (GSH-Px). These were analyzed

**\*Corresponding Author Ali Raza Memon** E mail: aliraza.biolumhs@yahoo.com

by ELISA technology.

The diabetic group advised that take 200grams of cooked tomato daily for 3 weeks (21days). In these days subjects were not given any antioxidant measures. Then compare the antioxidant biomarker levels before and after the tomato supplementation to determine the role of lycopene on oxidative stress in diabetic patients. SPSS version 16 was applied for statistical analysis. Student 't'

test was applied to see the significance of current study. MS Word & Excel 2007 was used to create tables.

## RESULTS

The biomarkers of oxidative stress like Superoxide dismutase (SOD), Glutathione (GSH), Glutathione reductase (GR), Glutathione peroxidase (GSH-Px) were estimated in diabetic group compare with control group as shown in table no: 01.

**Table 1. The biomarkers of oxidative stress like Superoxide dismutase (SOD), Glutathione (GSH), Glutathione reductase (GR), Glutathione peroxidase (GSH-Px) were estimated in diabetic group compare with control group**

Biomarker	Control Group (n=30)	Diabetic Group (n=30)
SOD U/g	1014.4 ± 120.75	403.72*** ± 45.90
GSH u/mol L	201.04 ± 12.27	103.49*** ± 10.63
GR U/L	60.05 ± 7.30	31.17*** ± 6.41
GSH-Px U/g	88.04 ± 3.85	36.06*** ± 7.52

(\*\*\* p. value < 0.001)

All biomarker enzymes are significantly low (p. value < 0.001) in diabetic patients as compared to control group.

**Table 2. The biomarkers level in diabetic group before and after the usage of lycopene present in tomatoes**

Biomarker	Diabetic Group without utilization of lycopene (n=30)	Diabetic Group which utilizes lycopene in tomatoes for 21 days (n=30)
SOD U/g	403.72±45.90	452.72** ±40.44
GSH u/mol L	103.49± 10.63	134.56** ± 8.69
GR U/L	31.17± 6.41	39.12* ± 5.56
GSH-Px U/g	36.06± 7.52	55.36** ±9.50

(\*\* p. value < 0.01, \*p. value < 0.05)

Above table clarified the effect of lycopene on oxidative stress in diabetic patients there were significantly increase in SOD (p. value < 0.01), GSH (p. value < 0.01), GR (p. value < 0.05) and GSH-Px (p. value < 0.01) levels.

## DISCUSSION

Lycopene is recently discovered as carotenoid compound which is highly present in red color pulp of tomatoes. It is beneficial in prevention of coronary artery diseases [3-5]. Several studies reported the beneficial effect of  $\beta$ -carotene intake in decreasing oxidative stress in diabetes. However so far no studies have focused on the effect of tomato lycopene on oxidative stress in diabetes whose singlet oxygen quenching ability is twice as higher than that of  $\beta$ -carotene and 10 times higher than that of alpha tocopherol [11]. In this study lower levels of oxidative stress biomarkers and increased were observed when compared with age matched normal control, which straightaway indicates the increased oxidative stress in diabetes, causing the imbalance between oxidants and antioxidants, which is normally maintained in healthy conditions, a key factor for diabetic complications. The lycopene, having good free radical scavenging capacity because of its unique structure (high number of conjugated double bonds) might have quenched the superoxide and other free radical anions which are highly released in diabetes due to the abnormal metabolism, thereby increasing the concentration of SOD, GSH-Px and GR, the most important cytosolic enzymes involved in antioxidant activities, there by reversing the disturbed balance to the antioxidant enzyme side, thus responsible for decreased

oxidative stress. In this study lycopene supplementation also increased the levels of reduced Glutathione, the most important antioxidant metabolite that plays an important role in maintaining good levels of Glutathione peroxidase activity which is the main enzyme involved in removing the  $H_2O_2$  generated from dismutation of superoxide anions by Super Oxide Dismutase. GSH is also the co-factor of several reducing enzymes such as dehydroascorbate reductase and endoperoxide isomerase [12].

The observations in the present study strongly prove the effective antioxidant property of tomato lycopene. Even though this effect is mainly due to lycopene, which accounts for ninety percent of total carotenoids and other phytochemicals present in tomatoes [8], the participation of other carotenoids in the antioxidant effect of tomatoes cannot be ruled out. So there is a need for extensive study on other carotenoids, which are present in very low concentration in tomatoes.

## CONCLUSION

Tomatoes lycopene have very important effect to reduce oxidative stress in type –II diabetic patients, it is highly beneficial to prevent diabetic patients from cardiac complications which mainly caused by high disturbance in oxidative stress.

## REFERENCES

1. Zimmet PZ, Mccarty DJ, De Couten MP. The global Epidemiology of non insulin dependent diabetes mellitus and the metabolic syndrome. *Journal of diabetes and its complications*, 11, 1997, 60-68.
2. Zimmet PZ, Lefebvre P. The global NIDDM epidemic. *Diabetology*, 39, 1996, 1247-1248.
3. Agrawal S and Rao AV. Tomato lycopene and low density lipoprotein oxidation a human dietary intervention study. *Lipids*, 33, 1998, 981-984.
4. Agrawal S and Rao A V. Role of lycopene as antioxidant carotenoids in the prevention of chronic diseases, a review. *Nutrition Research*, 19, 1999, 305-23.
5. Frederic Khachik, Lorena Carvalho, Paul S. Bernstein, Farth J. Muir. Chemistry, distribution and metabolism of tomato carotenoids and their impact on human health. *Experimental Biology and Medicine*, 227, 2002, 845-51.
6. Ford ES, Will JC, Bowman BA, Narayan KM. Diabetes Mellitus and serum carotenoids findings from the third national and nutritional examination survey. *American Journal of Epidemiology*, 149, 1999, 168-176.
7. Pfaffly JR. Review on Diabetic complications. *Free radicals in biology and medicine*, 77, 2001, 222.
8. Baynes J W. Role of oxidative stress in development of complications in diabetes. *Diabetes*, 40, 1991, 405-11.
9. Sies H and Stah W. Vitamin E, C, beta – carotene and other carotenoids as antioxidants. *American Journal of Clinical Nutrition*, 62, 1995, 1315sup-1321sup.
10. Jane E, Upritchard, Wayne H F, Sutherland Jim I Mann. Effect of supplementation with tomato juice, vitamin E and C on LDL oxidation and products of inflammatory activity in type - II diabetes. *Diabetes Care*, 23, 2000, 733-738.
11. Di Mascio P Kaiser S, Sies H Lycopene as a most effective biological carotenoid singlet oxygen quencher. *Archives of Biochemistry and Biophysics*, 274, 1989, 532-538.
12. Lenzi A, Picardo M, Gandini L, Lombardo F, Terminali O. Glutathione treatment of dyspermia: effect on lipoperoxidation process. *Human Reproduction*, 9(11), 1994, 2044-2050.