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# A study on lipid peroxidation and total antioxidant status in diabetes with and without hypertension

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**ABSTRACT**

Lipid peroxidation refers to the oxidative degradation of lipids. The occurrence of free radical induces lipid peroxidation causing considerable change in the cell membrane. Total antioxidant status gives the information about all of the antioxidants in the organisms. This study was designed to find out the correlation between Lipid peroxidation (LPO), Total antioxidant levels to severity and complications of diabetes mellitus and diabetes mellitus with hypertension. This study was conducted on total of 160 participants attending A.B. Shetty Memorial Institute of Dental Sciences. Blood sample was collected and serum was utilized for subsequent analysis. The total antioxidant status was estimated using phosphomolybdenum method and lipid peroxidation level is estimated using TBA method. Total antioxidant level significantly decreases (p=0.0324) in diabetic in comparison with the control subjects, whereas the lipid peroxidation increase significantly (p=0.0192).

**Keywords:** Non Insulin Dependent Diabetes Mellitus, Lipid peroxidation, Total antioxidant, Hypertension, Random Blood Sugar (RBS).

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## INTRODUCTION

Diabetes mellitus often referred to simply as diabetes , is a syndrome of disordered metabolism, usually due to a combination of hereditary and environmental causes, resulting in abnormally high blood sugar levels (hyperglycemia). Blood glucose levels are controlled by a complex interaction of multiple chemicals and hormones in the body, including the hormone insulin made in the beta cells of the pancreas. Diabetes mellitus refers to the group of diseases that lead to high blood glucose levels due to defects in either insulin secretion or insulin action in the body.

Diabetes and its treatments can cause many complications. Acute complications including hypoglycemia, ketoacidosis, or nonketotic hyperosmolar coma may occur if the disease is not adequately controlled. Serious long-term complications include cardiovascular disease, chronic renal failure, retinal damage, which can lead to blindness, several types of nerve damage, and micro vascular damage, which may cause erectile dysfunction and poor wound healing. Poor healing of wounds, particularly of the feet, can lead to gangrene, and possibly to amputation. [1]

Hypertension, also referred to as high blood pressure known as the silent killer, HTN or HPN, is a medical condition in which the blood pressure is chronically elevated. In current usage, the word "hypertension" without a qualifier normally refers to systemic, arterial hypertension. Persistent hypertension is one of the risk factors for strokes, heart attacks, heart failure and arterial aneurysm, and is a leading cause of chronic renal failure. Even moderate elevation of arterial blood pressure leads to shortened life expectancy. At severely high pressures, defined as mean arterial pressures 50% or more above average, a person can expect to live no more than a few years unless appropriately treated. Beginning at a systolic pressure (which is peak pressure in the arteries, which occurs near the end of the cardiac cycle when the ventricles are contracting) of 115 mmHg and diastolic pressure (which is minimum pressure in the arteries, which occurs near the beginning of the cardiac cycle when the ventricles are filled with blood) of 75 mmHg (commonly written as 115/75 mmHg), cardiovascular disease (CVD) risk doubles for each increment of 20/10 mmHg.

Myeloperoxidase (MPO) is a peroxidase enzyme (EC 1.11.1.7) most abundantly present in neutrophil granulocytes (a subtype of white blood cells). It is a lysosomal protein stored in azurophilic granules of the neutrophil. MPO has a heme pigment, which causes its green color in secretions rich in neutrophils, such as pus and some forms of mucus. [2].Lipid peroxidation refers to the oxidative degradation of lipids. It is the process whereby free radicals "steal" electrons from the lipids in cell membranes, resulting in cell damage. This process proceeds by a free radical chain reaction mechanism. It most often affects polyunsaturated fatty acids, because they contain multiple double bonds in between which lies methylene -CH2- groups that possess especially reactive hydrogen’s. [3].

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Living organisms have evolved different molecules that speed up termination by catching free radicals and therefore protect the cell membrane. One important such antioxidant is vitamin E. Other anti-oxidants made within the body include the enzymes superoxide dismutase, catalase, and peroxidase. In addition, end products of lipid peroxidation may be mutagenic and carcinogenic . For instance, the end product malondialdehyde reacts with deoxyadenosine and deoxyguanosine in DNA, forming DNA adducts to them, primarily $M_1G$. [4].

Free radicals are electrically charged molecules, i.e., they have an unpaired electron, which causes them to seek out and capture electrons from other substances in order to neutralize themselves. Antioxidants are capable of stabilizing, or deactivating, free radicals before they attack cells. Antioxidants are absolutely critical for maintaining optimal cellular and systemic health and well-being. Hence body maintains complex system of enzymatic antioxidants such as catalase, SOD, peroxidases etc. and non enzymatic antioxidants such as Vit C, E & glutathione etc. Oxidative stress occurs as a result of increased oxidative metabolism. An inadequate intake of antioxidant nutrients may compromise antioxidant potential, thus compounding overall oxidative stress .Conditions associated with oxidative damage include heart disease, cancer, pulmonary disorders, ageing etc. [5].On these backgrounds, the present work was designed to determine the levels of lipid peroxidation and total antioxidant status in diabetes patients and to estimate the levels of lipid peroxidation and total antioxidant status in diabetes with hypertension patients.

## METHODS AND MATERIALS

The present study was conducted after getting the clearance from the institutional ethical committee. The study group included 160 participants, who were divided into diabetics without hypertension and diabetics with hypertension of 80 patients each from the oral medicine department of A.B Shetty Memorial institute of dental science. 1 ml of blood sample was collected in fluoride bottle to separate plasma. 2ml of blood collected in a plain bottle, centrifuged to separate serum. Plasma was tested for blood glucose using GOD-POD method. Lipid peroxidation level is estimated using TBA method. Total antioxidant level was estimated using Phosphomolybdenum method.

**Statistical Analysis:** The obtained data was statistically analyzed for its significance by student t-test. P value less than 0.05 was considered the level of significance.

## RESULTS

In our present study we analyzed the level of total antioxidant and lipid peroxidation in Diabetics with and without hypertension and were compared with the healthy individuals.

In this study we found that, the total antioxidant level in hypertensive diabetics was declined significantly ($p=0.0324$) as compared with normal adults (Table-1 and Fig-1). Whereas,

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it was slightly decreased in non-hypertensive diabetics. We also found that, the lipid peroxidation in hypertensive diabetics and non-hypertensive diabetics was increased significantly (p= 0.0324 and 0.0192 respectively) as compared with normal adults (Table-2 and Fig-2).

**Table-1:** Total antioxidant levels in healthy subjects, Diabetics without hypertension and Diabetics with hypertension. Values are expressed as Mean ± S.D and n=80 in each groups.

| Subjects | Total Antioxidant | P-value |
|---|---|---|
| **Control** | 311.8±37.63 | ---- |
| **Diabetics without hypertension** | 247.1±90.72 | 0.836 |
| **Diabetics with hypertension** | 232.9±86.07 | 0.0324 |

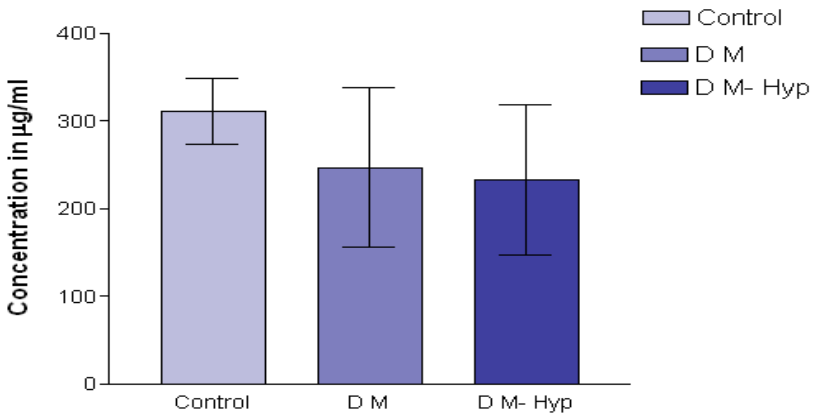


**Fig-1:** Comparison of Total antioxidant levels in healthy subjects, Diabetics without hypertension and Diabetics with hypertension. DM indicates diabetics without hypertension, DM-Hyp indicates diabetics with hypertension.

**Table-2: Lipid peroxidation** in healthy subjects, Diabetics without hypertension and Diabetics with hypertension. Values are expressed as Mean ± S.D and n=80 in each groups.

| Subjects | Lipid Peroxidation | P-value |
|---|---|---|
| **Control** | 0.3011 ± 0.01292 | ---- |
| **Diabetics without hypertension** | 0.673 ± 0.3975 | 0.0192 |
| **Diabetics with hypertension** | 1.084±0.2420 | 0.0324 |

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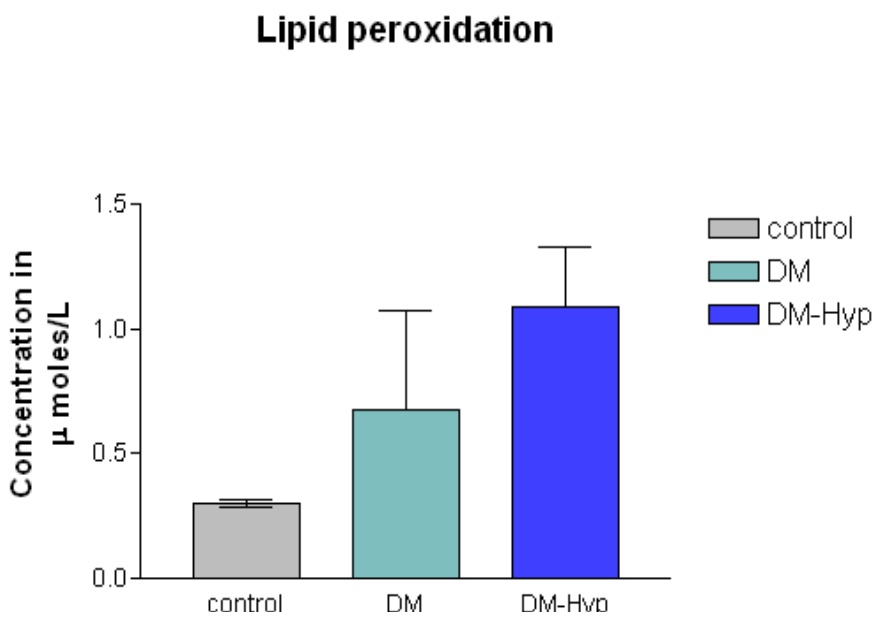


**Fig-2:** Comparison of Lipid peroxidation in healthy subjects, Diabetics without hypertension and Diabetics with hypertension. DM indicates diabetics without hypertension, DM-Hyp indicates diabetics with hypertension.

## DISCUSSION

Total Antioxidant level is found to be decreased in Type II Diabetes Mellitus patients compared to the Control, these total antioxidants act as antagonist to the free radicals hence reducing the risks of CAD, the depleted levels of Total Antioxidants may be responsible for the complications associated with DM. Lipid Peroxidation is elevated in DM patients in comparison with the control. This is may be due to the decreased levels of Total Antioxidants or vice versa, due to this in DM patients increased damage at cellular level can be observed, which may lead to the secondary complications associated with the disease.

An antioxidant is a molecule capable of inhibiting the oxidation of other molecules. Oxidation is a chemical reaction that transfers electrons from a substance to an oxidizing agent. Oxidation reactions can produce free radicals. In turn, these radicals can start chain reactions that damage cells. Antioxidants terminate these chain reactions by removing free radical intermediates, and inhibit other oxidation reactions. They do this by being oxidized themselves, so antioxidants are often reducing agents such as thiols, ascorbic acid or polyphenols. Although oxidation reactions are crucial for life, they can also be damaging; hence, plants and animals maintain complex systems of multiple types of antioxidants, such as glutathione, vitamin C, and vitamin E as well as enzymes such as catalase, superoxide dismutase and various peroxidase. Low levels of antioxidants, or inhibition of the antioxidant enzymes, cause oxidative stress and may damage or kill cells.

Lipid peroxidation refers to the oxidative degradation of lipids. It is the process whereby free radicals "steal" electrons from the lipids in cell membranes, resulting in cell damage. This process proceeds by a free radical chain reaction mechanism. It most often affects polyunsaturated fatty acids, because they contain multiple double bonds in between which lie methylene -CH2- groups that possess especially reactive hydrogens. As with any radical reaction the reaction consists of three major steps: initiation, propagation and termination. Thus from our study we concluded that antioxidant level in hypertensive diabetics was less and lipid peroxidation activity was less in dibetics.

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