



Original Research Article

Relationship of Schizophrenia with Lipid Peroxidation and Total Antioxidant Capacity

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ABSTRACT

There are large growing data demonstrating that reactive oxygen species are involved in initiation and development of many different neuropsychiatric disorders including schizophrenia. This study aims to measure the lipid peroxidation and total antioxidant capacity in schizophrenic patients. In the present study, 30 schizophrenic patients and 30 age and sex matched healthy controls were included. The blood samples were collected, and investigated for Malondialdehyde (MDA) and total antioxidant capacity in schizophrenic patients and control subjects. The level of Malondialdehyde (MDA) was found to be significantly increased in patients than healthy controls; also a significant decrease in total antioxidant capacity in schizophrenic patients was seen as compared to controls. Consequently, the present study emphasizes the growing consideration that free radical damage may have an important etio-pathogenetic role on the development of schizophrenia and suggests that decreased plasma total antioxidant levels may be related to the progression of illness. These findings also provide theoretical basis for the development of novel therapeutic strategies such as antioxidant supplementation.

Keywords: Schizophrenia; malondialdehyde (MDA); total antioxidant capacity (TAC); oxidative stress; reactive oxygen species (ROS)

INTRODUCTION

Free radicals and Reactive Oxygen Species (ROS) generated during aerobic metabolism can affect certain processes leading to clinical manifestations.

There is abundant evidence that free radicals involved in membrane patho physiology in the central nervous system and may play a role in schizophrenia [1]. Moreover, the body's defence

mechanisms would play an important role in the form of antioxidants and try to minimize the damage, adopting itself to the stressful situation [1, 2]. An alteration in the oxidant and antioxidant profile is known to occur in pathophysiology of many disorders including schizophrenia.

Lipid peroxidation may be initiated by OH^\cdot , O_2^\cdot or OH_2^\cdot radicals. Final products of lipid oxidation include aldehydes especially Malondialdehyde (MDA), lipid peroxidation products diffuse to different cell parts, damaging protein - lipid membranes. Lipid peroxidation products disturb vessel permeability and neuronal conduction [2]. Free radicals adversely modify biologically active molecules and implicated in various complications. Blood contains many antioxidant molecules that prevent or inhibit harmful free reactions [3]. Plasma concentrations of antioxidants can be measured separately in the laboratory, but these measurements are time consuming. Thus the total antioxidant capacity summarizes the overall activity of non-enzymatic antioxidants and antioxidant enzymes.

If, the homeostasis between rate of formation of free radicals and the rate of their neutralization is not occurred or maintained, an oxidative damage can occur which is known as oxidative stress. Oxidative stress is a result of increased formation of free radicals or reduced anti oxidative capacity [4]. In the present study, the level of lipid peroxidation product (MDA), the total antioxidant capacity and their association were assessed in schizophrenia.

MATERIAL AND METHODS

The present study was carried out in Department of Biochemistry Dr. V. M. Government Medical College, Solapur, in collaboration with Shree Chhatrapati Shivaji Maharaj General Hospital, Solapur, (Maharashtra). The protocol was approved by Ethical committee of the institute. The consent form was obtained from the relatives of patients. A total of 60 individuals were included in this study.

Out of these, 30 were clinically diagnosed as schizophrenic patients.

The study subjects having disorders associated with heart, lung, liver, kidney and other pivotal organs were excluded from the study. All the patients were comprised of clinically diagnosed schizophrenic patients of age group between 20 to 55 years. Diagnosis of schizophrenia was made by Psychiatrists by using Diagnostic and statistical Manual of Mental Disorders (DSM-IV) classification (American Psychiatric Association, 1994) [5].

The venous blood samples were collected from the subjects under aseptic condition by venepuncture using 10ml sterile syringe and needle. About 8ml of random blood was collected of which 3ml was poured into sterile vacutainer containing heparin for the estimation of total antioxidant capacity blood was taken into sterile vacutainer for estimation of other parameters. Then the plasma and serum were separated by centrifugation at 3000 rpm for 5-10 minutes and unhemolyzed samples were taken for the assays. Serum malondialdehyde was determined by a Kei-Satoh method [6], and The plasma total antioxidant capacity by FRAP assay [7] i.e. ferric reducing ability of plasma.

All the values biochemical parameters of patients and controls were expressed as mean \pm SD. All the biochemical parameters measured in study group subjects were statistically compared with those estimated in control by using student "t" test. Correlations between the variables were estimated by Pearson's correlation coefficient. The difference was considered significant, when the $p < 0.05$.

RESULTS

The present study was aimed to study the biochemical parameters viz. lipid peroxidation product malondialdehyde (MDA) and total antioxidant capacity (TAC) in the patients of schizophrenia and healthy controls. The levels of malondialdehyde was increased significantly

($p < 0.05$) in patients of schizophrenia when compared with healthy controls, while, the level of total antioxidant capacity (TAC) was found to be significantly ($p < 0.05$) decreased in patients of schizophrenia than the healthy controls. The results are depicted in table 1.

The correlation between MDA was studied with Total antioxidant capacity (TAC). We found negative association between plasma total antioxidant capacity (TAC) and MDA with r value of -0.95 and associated p value < 0.01 . The values are depicted in table no.2.

Table 1. Levels of Malondialdehyde (MDA) and Plasma total antioxidant capacity (TAC) in healthy controls and schizophrenic patients.

Biochemical Parameters	Healthy controls (n=30)	Patients (n=30)
Serum MDA (nmol/dl)	258.93±92.40	405.3±248.75*
TAC(μmol/l)	968.00±41.97	589.00±24.30*

*Highly significant

Table 2. Association of Malondialdehyde (MDA) with Total antioxidant capacity

Parameters	MDA	
	'r'	P
Total antioxidant capacity (TAC)	-0.954	<0.01*

*Statistically significant.

DISCUSSION

Antioxidant molecules protect from free radical induced damage by preventing the formation of radicals, scavenging them or by promoting their decomposition. Thus, it is of extreme importance to measure these factors in assessing in vivo antioxidant status in different physiopathological situations [8 -10]. We observed that, total antioxidant capacity was decreased significantly in schizophrenic patients when compared with healthy controls ($P < 0.01$). Li Hui Chun et al. [11], E Sofic et al. [12], J. Yao [13], Isam Hamo Mahmood et al. [14] suggested a low level of Total antioxidant capacity (TAC) in schizophrenia. This may indicate that, oxidative stress had occurred in such patients which

may have exhausted the antioxidant capacity of the body. Rukmini M.S., Benedicta D'souza et al. [15], Birsan Ozyurt, Fikret et al [16], Meena Arvindakshan et al. [17], Dusica Pavlovic, Vensna Tamburic et al. [18], showed significant increase in plasma MDA level in patients. Our study supports, all the above mentioned authors because, there is accumulating evidence of altered antioxidant enzymes activities, increased lipid peroxidation products in plasma and low levels of esterified polyunsaturated essential fatty acids in schizophrenics. This may indicate that, oxidative injury contributes to the pathophysiology of schizophrenia.

Another reason is that total antioxidant capacity decreases when the production of ROS increases

and antioxidants protect the body from these free radicals by scavenging them, or by promoting their decomposition and preventing lipid peroxidation that means, they reduces the oxidizable molecules and protect from oxidizable compounds so that, single measurement of total antioxidant capacity in plasma or serum is not going to be sufficient but, a battery or measurements which should include measurement of oxidative damage will be necessary to adequately assess oxidative stress in vivo [14]. Negative correlation between TAC and MDA ($r=-0.95$) were found in schizophrenic patients indicating increased free radical generation and impaired antioxidant defence system in schizophrenia. Total antioxidant capacity in the present study was found to be decreased significantly ($p<0.01$) in study group subjects when compared with control subjects. Decreased TAC may be a result of increased ROS generation during the disease process which may cause brain injury in schizophrenia. Thus, in Schizophrenia gives an opportunity for using these parameters as markers for evaluation of this disease and findings provide to develop novel strategies for diagnosis, prognosis, and also provide theoretical basis for the development of novel therapeutic strategies such as antioxidant supplementation of schizophrenic patients are warranted.

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